TETRA TECH

PHIL-25518

February 14, 2014

Project Number 04635

Mr. Brad White (3HS22)
U.S. Environmental Protection Agency (EPA) - Region 3
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Reference: Remedial Action Contract - EPA Region 3
EPA Contract Number EP-S3-07-04

Subject: Summary of Round 2 ISCO Injection Program
Valmont TCE Site
Long-Term Remedial Action (LTRA)
EPA Work Assignment No. 052-RALR-031M

Dear Mr. White:

Enclosed is a brief summary of the Round 2 in-situ chemical oxidation (ISCO) injections at the subject site. Tetra Tech conducted injections in May 2013 and completed post-injection monitoring in December 2013. The enclosure also provides information regarding the possible approach for implementing the next round of the ISCO remedy (Round 3) based on current TCE concentrations, post-injection monitoring results, and past ISCO injection events. The Round 3 approach is for discussion purposes and may include:

- Treatment at shallow wells currently containing at least 500 micrograms/liter (µg/L) of TCE (e.g., wells MW-10A, MW-11S, MW-28S, and possibly E-2).
- Treatment at deeper wells containing more than 100 µg/L of TCE (e.g., MW-11D, MW-22D, E-4, E-6, E-7, E-9, and possibly E-3).
- Injection of oxidant solution into other selected existing wells and intervals.
- Installation of one or more new injection wells, particularly inside the existing building.
- Use of RemOx® sustained-released (SR) permanganate in a wax candle-type matrix, particularly for a few wells in the adjacent neighborhood.
- Post-injection or post-treatment monitoring.

Sincerely,

Neil Teamerson

Neil Teamerson
Project Manager

NT/nfs

Enclosure

c: Vince Shickora (Tetra Tech)
File No. 3

Tetra Tech, Inc.
234 Mall Boulevard, Suite 260, King of Prussia, PA 19406-2954
Tel 610.491.9688 Fax 610.491.9645 www.tetratech.com

ENCLOSURE

SUMMARY OF ROUND 2 ISCO INJECTION PROGRAM
VALMONT TCE SITE
WEST HAZLETON BOROUGH AND HAZLE TOWNSHIP, PENNSYLVANIA

1.0 INTRODUCTION

This summary highlights Round 2 in-situ chemical oxidation (ISCO) injection activities at the subject site; provides the evaluation of pressure transducer results recorded during the injections; presents the post-injection monitoring program results; proposes the ISCO injection approach for future remedial efforts; and briefly describes lessons learned during the injection field work.

2.0 INJECTION OPERATIONS

Permanganate injections, using a pre-mixed solution of 10% sodium permanganate ($NaMnO_4$) in water, commenced May 20, 2013 and were completed May 31, 2013. Figure 1 shows the existing well network and the locations of the Round 2 injection wells. Table 1 summarizes injection activities by well. Approximately 9,300 gallons of oxidant solution were injected into specific depth intervals in the bedrock beneath the site.

TABLE 1
SUMMARY OF INJECTION ACTIVITIES
VALMONT TCE SITE
WEST HAZLETON BOROUGH AND HAZLE TOWNSHIP, PENNSYLVANIA

INJECTION WELL/ INTERVAL	HYDRAULIC PUMP UNIT PRESSURE (psi)	QUANTITY OF PERMANGANATE SOLUTION USED (gallons)	VOLUME OF WATER USED* (gallons)
E-1 May 20, 2013			
20-40 ft.	30	200	50
E-1 May 21, 2013			
20-40 ft.	36	889	210
MW-10A May 21, 2013			
36-46 ft.	20	136	15
E-7 May 21, 2013			
18-38 ft.	37	545	250
40-60 ft.	30	545	244
MW-11S May 22, 2013			
44-54 ft.	33	136	30

TABLE 1
SUMMARY OF INJECTION ACTIVITIES
VALMONT TCE SITE
WEST HAZLETON BOROUGH AND HAZLE TOWNSHIP, PENNSYLVANIA

INJECTION WELL/ INTERVAL	HYDRAULIC PUMP UNIT PRESSURE (psi)	QUANTITY OF PERMANGANATE SOLUTION USED (gallons)	VOLUME OF WATER USED* (gallons)
E-2 May 22, 2013			
32-52 ft.	13	609	0
70-90 ft.	70	7	0
90-110 ft.	85	62	0
E-4 May 23, 2013			
30-50 ft.	31	1425	250
MW-22D May 23, 2013			
294-304 ft.	22	110	50
MW-18S May 28, 2013			
16-36 ft.	38	545	50
MW-28S May 28, 2013			
35-45 ft.	35	272	50
E-6 May 29, 2013			
95-115 ft.	115	130	15
E-9 May 29, 2013			
30-40 ft.	22	854	150
E-3 May 30, 2013			
40-60 ft.	45	950	250
E-2 May 30, 2013			
90-150 ft.	80	402	200
MW-12S May 30, 2013			
45-58 ft.	20	177	25
MW-13I May 31, 2013			
78-88 ft.	5	136	25
MW-13S May 31, 2013			
20-35 ft	5	204	25
E-5 May 31, 2013			
43-63 ft.	5	970	200
	TOTALS	**9,304**	**2,089**

* Water used to flush permanganate from injection system

3.0 PRESSURE TRANSDUCER RESULTS

During the injections, pressure transducers were installed in selected nearby wells to record relative water-level changes. The pressure transducer data were used to evaluate the radius of influence (ROI) associated with the injection wells. Significant changes in water level (more than a foot) were noted in monitoring wells near each injection well. Water level changes of a foot or more were considered indicative of a hydraulic connection with the injecting well. Appendix A provides charts of the pressure transducer data for each injection event. Table 2 summarizes these results.

Review of the transducer data indicated that, generally, injections in the intermediate depth intervals between 20 feet and 60 feet below ground had the most effect in terms of maximum changes in water levels (one foot or greater). These maximum water level changes could extend from approximately 100 ft to approximately 265 ft from the injection site. Deeper injection intervals (90 ft to 300 ft) had a ROI that extended from approximately 100 ft to approximately 300 ft based on only two injection events, E-2 at 90 ft to 150 ft and M-22D at 294 ft to 304 ft.

During the injection in well E-2 at 32 ft to 52 ft, water and permanganate rose out of the ground around the well casings at monitoring well MW-11D and E-2 forcing a halt to the injection.

Based on the pressure transducer results, a minimum ROI of between 100 ft and 265 ft was estimated for the injection events in the shallow to intermediate depth intervals (20 ft to 60 ft). A minimum ROI of 100 ft to 300 ft was estimated for the deeper depth intervals.

4.0 POST-INJECTION MONITORING PROGRAM

Tetra Tech obtained groundwater samples from selected wells on a periodic basis following the Round 2 ISCO injection event. The monitoring program was intended to help determine the effectiveness of the injections and measure the spread of the solution (both laterally and vertically). Samples were collected from the monitoring wells for both chemical and physical parameter analyses. Table 3 summarizes the monitoring events.

After Round 2 injections, Tetra Tech evaluated if monitoring wells near injection wells were affected by the oxidant solution by process monitoring. Process monitoring consisted of observing monitoring wells for visual presence of permanganate, and recording changes in certain chemical (i.e., chloride) and physical (i.e., pH, ORP, conductivity, DO, temperature, and colorimeter) water quality parameters.

TABLE 2
SUMMARY OF PRESSURE TRANSDUCER RESULTS ROUND 2 INJECTIONS
MAY 20 - 31, 2013
VALMONT TCE SITE
WEST HAZLETON BOROUGH AND HAZLE TOWNSHIP, PENNSYLVANIA
PAGE 1 of 2

Monitored Depth Interval	E-1		E-2					E-3		E-4		E-5		E-6		E-7		
	dist.	20-40'* Maximum Δ	dist.	32-52'*	70-90'* Maximum Δ	90-110'*	90-150'*	dist.	40-60'* Maximum Δ	dist.	30-50'* Maximum Δ	dist.	43-63'* Maximum Δ	dist.	95-115'* Maximum Δ	dist.	18-38'* Maximum Δ	40-60'*
E-3 (19-150')	265	0.7	390	0.4	<0.01	0.05	---	0	----	195	1.4	330	----	70	----	398	0.6	0.4
E-4 (19-150')	150	0.7	195	0.03	<0.01	<0.01	---	195	----	0	---	383	----	150	----	203	0.2	0.8
E-6 ((19-150')	270	<0.01	330	0.01	<0.01	0.02	---	75	----	150	---	285	----	0	----	535	0.02	0.03
E-7 (19-100')	173	2.4	135	---	---	---	---	398	----	195	---	540	----	353	----	0	---	--
E-8 (19-120')	420	---	203	---	---	---	0.2	420	0.01	300	0.01	315	0.02	345	<0.01	345	<0.01	0.02
E-9 (30-100')	353	---	353	---	---	---	---	135	---	218	---	195	---	90	---	405	---	---
MW-2I (70-80')	668	---	615	---	---	---	0.04	420	0.05	533	---	165	1.3	405	---	705	---	---
MW-2S (44-54')	668	---	615	---	---	---	0.07	420	0.02	533	---	165	1	405	---	705	---	---
MW-06I (88-98')	255	0.1	360	0.03	<0.01	0.04	0.01	540	0.1	375	0.11	750	0.02	593	0.02	225	0.07	0.1
MW-06S (24-34')	255	0.2	360	<0.01	<0.01	0.02	0.01	540	0.02	375	0.12	750	<0.01	593	0.03	225	0.02	0.3
MW-10B (65-75')	38	0.8	240	<0.01	<0.01	0.04	0.9	315	0.7	155	0.82	540	0.02	293	0.31	135	0.6	1.4
MW-10C (104-114'	30	0.2	248	<0.01	<0.01	0.02	0.6	300	0.4	165	0.41	533	0.03	285	0.06	150	0.1	0.34
MW-12I (88-98')	255	0.2	386	0.03	<0.01	0.01	0.3	50	1.4	195	0.63	375	0.1	98	0.06	390	0.2	0.2
MW-12S (45-58')	255	0.9	386	0.01	<0.01	0.05	---	50	---	195	0.56	375	---	98	0.02	390	<0.01	0.3
MW-13D (122-132'	510	---	518	---	<0.01	---	0.1	240	0.5	380	---	180	0.3	225	0.04	570	---	---
MW-13S (20-35')	510	---	518	---	---	---	---	240	<0.01	380	---	180	---	225	0.01	570	---	---
MW-14S (35-50')	488	---	285	---	---	---	---	435	---	353	---	255	1.1	360	---	413	---	---
MW-15I (90-105')	203	0.7	98	0.03	<0.01	0.02	3.7	398	0.7	195	1.4	518	0.01	353	0.02	45	0.4	1.2
MW-15S (48-58')	203	0.5	98	0.01	<0.01	0.3	0.9	398	0.12	195	0.7	518	0.04	353	0.03	45	0.4	1.8
MW-16S (30-45')	210	---	450	---	---	---	0.02	225	0.38	265	0.08	555	0.04	270	0.04	368	---	---
MW-18S (14-36')	270	0.4	338	<0.01	<0.01	0.1	---	68	---	143	0.06	360	---	75	---	330	0.3	0.4
MW-28I (55-65')	143	2.9	120	---	<0.01	0.01	0.7	293	0.86	113	6.4	443	0.03	255	0.01	105	0.9	3.3
MW-28S (35-45')	150	4.4	113	---	<0.01	0.04	---	300	---	108	7.1	443	---	255	---	105	0.07	8.6

Note:

* Injection Depth Interval

Maximum Δ - maximum change in water level (increase or decrease) in feet, per injection interval per injection event

--- Indicates that a transducer was not used

dist. Distance from injection well to monitoring well, in feet

Indicates a water level change (increase or decrease) greater than 1 foot

TABLE 2
SUMMARY OF PRESSURE TRANSDUCER RESULTS ROUND 2 INJECTIONS
MAY 20 - 31, 2013
VALMONT TCE SITE
WEST HAZLETON BOROUGH AND HAZLE TOWNSHIP, PENNSYLVANIA
PAGE 2 of 2

Monitored Depth Interval	dist.	E-9 30-40'* Maximum Δ	dist.	MW-10A 36-46'* Maximum Δ	dist.	MW-11S 44-54'* Maximum Δ	dist.	MW-12S 45-58'* Maximum Δ	dist.	MW-13I 78-88'* Maximum Δ	dist.	MW-13S 20-35'* Maximum Δ	dist.	MW-18S 16-36'* Maximum Δ	dist.	MW-22D 294-304'* Maximum Δ	dist.	MW-28S 36-45'* Maximum Δ
E-3 (19-150')	135	----	323	0.5	375	---	45	----	240	----	240	----	60	0.68	30	0.3	300	0.2
E-4 (19-150')	218	----	158	0.07	210	0.02	188	----	375	----	375	----	135	----	225	----	105	----
E-6 ((19-150')	90	----	300	<0.01	315	<0.01	100	----	225	----	225	----	75	----	75	----	255	----
E-7 (19-100')	405	----	120	1	210	---	375	----	570	----	570	----	330	----	420	----	105	----
E-8 (19-120')	323	0.01	398	----	128	0.03	450	0.02	450	<0.01	450	<0.01	390	0.01	420	0.01	285	0.01
E-9 (30-100')	0	---	375	----	315	----	180	---	165	;---	165	---	165	;---	120	;---	300	;---
MW-2I (70-80')	323	---	690	----	555	----	480	0.03	195	---	195	0.27	480	---	390	---	600	---
MW-2S (44-54')	323	---	690	----	555	----	480	0.1	195	0.25	195	0.2	480	---	390	---	600	---
MW-06I (88-98')	600	0.01	225	0.2	435	----	510	0.03	750	0.01	750	<0.01	465	0.02	570	0.06	315	0.04
MW-06S (24-34')	600	0.01	225	0.04	435	----	510	0.02	750	<0.01	750	0.01	465	0.01	570	0.03	315	0.1
MW-10B (65-75')	368	0.06	1	1.8	285	0.01	285	0.3	525	0.03	525	0.02	255	0.2	345	0.3	270	0.5
MW-10C (104-114'	363	0.02	5	0.7	290	0.02	280	0.08	520	0.06	520	0.05	250	0.06	340	0.2	275	0.1
MW-12I (88-98')	315	0.5	300	0.4	390	----	1	0.49	285	0.2	285	0.08	45	0.03	75	0.09	285	0.1
MW-12S (45-58')	315	0.5	300	0.3	390	----	0	---	285	---	285	---	45	0.04	75	0.05	285	0.2
MW-13D (122-132'	165	0.04	522	---	458	----	285	0.17	1	0.4	1	0.2	285	---	210	---	465	---
MW-13S (20-35')	165	0.2	522	---	458	----	285	0.01	0	---	0	---	285	---	210	---	465	---
MW-14S (35-50')	315	---	472	---	210	----	465	---	420	0.1	420	0.1	420	---	435	---	345	---
MW-15I (90-105')	398	0.1	150	1.9	173	0.08	390	0.07	555	0.01	555	0.01	345	0.3	420	0.5	105	0.7
MW-15S (48-58')	398	0.1	150	0.09	173	0.4	390	0.08	555	0.01	555	0.01	345	0.2	420	0.3	105	0.9
MW-16S (30-45')	375	<0.01	260	---	473	---	180	0.09	465	0.02	465	0.03	195	0.02	255	0.04	315	<0.01
MW-18S (14-36')	165	---	255	0.5	330	0.2	45	---	300	---	300	0	0	---	100	0.2	255	---
MW-28I (55-65')	304	0.2	120	0.03	158	0.2	135	0.13	465	0.01	465	0.02	240	3	315	1.5	1	5.9
MW-28S (35-45')	304	---	120	2	158	0.2	135	---	465	---	465	---	240	---	315	0.8	0	---

Note:

* Injection Depth Interval

Maximum Δ - maximum change in water level (increase or decrease) in feet, per injection interval per injection event

--- Indicates that a tranducer was not used

dist. Distance from injection well to monitoring well, in feet

Indicates a water level change (increase or decrease) greater than 1 foot

TABLE 3
SUMMARY OF POST-INJECTION MONITORING ACTIVITIES
VALMONT TCE SITE
LUZERNE COUNTY, PENNSYLVANIA

ROUND	DATE	PROCESS MONITORING	PERFORMANCE MONITORING	COMMENTS
1	06/27/13	●	---	About 1 Month After Round 2 Injections
2	08/05/13	●	---	About 2 Months After Injections
3	09/09/13	●	●	About 3 Months After Injections
4	10/17/13	●	---	About 4.5 Months After Injections
5	11/14/13	●	---	About 6 Months After Injections
6	12/16/13	●	●	About 7 Months After Injections

Samples were not collected for fixed-base laboratory analyses during process monitoring. The post-injection process monitoring events occurred six times as shown in Table 3. These events involved up to 28 wells each time, and lasted approximately 2 days per event (including mobilization, equipment rentals, travel, and reporting). Table 4 shows the results of process monitoring. Appendix B summarizes the field instrument instruments obtained during these events.

As part of the monitoring program, Tetra Tech conducted two rounds of performance monitoring. These events occurred during Month 3 (September 2013) and Month 7 (December 2013). Low-flow sampling techniques were employed for screened wells, while the team purged one volume of groundwater from most open borehole wells. If the permanganate ion (MnO_4^-) was present in a particular monitoring well, samples were generally not taken from that well. However, a few samples during both rounds containing the presence of permanganate were preserved using ascorbic acid in accordance with EPA/600/R-12/049 *Groundwater Sample Preservation at In-Situ Chemical Oxidation Sites - Recommended Guidelines* (EPA, 2012).

Open borehole wells were sampled by first purging a selected volume from each well. A total of 225 gallons of groundwater was purged from wells GW-21 and GW-9. A total of 110 gallons was purged from wells E-2 and E-7. A total of 100 gallons was purged from wells E-5, E-8, and E-9. Well E-4 was purged of 150 gallons. These wells were purged and sampled using a submersible pump with an adjustable flow rate. The purge water discharge was monitored periodically for pH, specific conductivity, turbidity, ORP,

TABLE 4
VALMONT TCE SITE
POST-INJECTION MONITORING (PIM) EVENTS
WEST HAZLETON AND HAZLE TOWNSHIP, PENNSYLVANIA
(As of December 23, 2013)

SCREEN / INTERVAL	LOW FLOW (1)	WELL	DATE OF MONITORING						TCE LEVEL (µg/L)		COMMENTS	CHLORIDE
			6/27/2013	8/5/2013	9/9/2013	10/17/2013	11/14/2013	12/23/2013				
			Round 1 (Month 1)	Round 2 (Month 2)	Round 3 (Month 3)	Round 4 (Months 4-5)	Round 5 (Month 6)	Round 6 (Month 7)	PRE-INJ. (DATE)	POST-INJ. (DATES)		
19-150	No	**E-1**	Purple	Purple	Purple	Purple	Purple	Purple	780 (5/09)	NA	1,089 gallons injected 5/13	● (2)
19-150	No	**E-2**	Pink	Lt. Brown	Purple	Pink	Clear	Clear	220 J (8/12)	450 (12/13)	1,080 gallons injected	● (3)
19-150	No	**E-3**	Purple	Purple	Purple	Purple	Purple	Purple	4,000 (5/09)	NA	950 gallons injected	● (2)
19-150	No	**E-4**	Purple	Purple	Purple	Purple	Pink	Clear	1,200 J (8/12)	250 (12/13)	1,425 gallons injected	● (2)
19-100	No	**E-5**	Purple	Pink	Purple	Clear	Clear	Clear	81 (8/12)	19 (12/13)	970 gallons injected	● (3)
19-150	No	**E-6**	Purple	Purple	Purple	Purple	Purple	Purple	ND (11/12)	NA	130 gallons injected	● (2)
19-100	No	**E-7**	Purple	Purple	Purple	Purple	Purple	Purple	160 (11/12)	190 (12/13)	1,090 gallons injected	● (2)
19-120	No	E-8	NA	NA	Clear	NA	NA	NA	410 J (8/12)	250 (9/13); 165 (12/13)		● (2)
30-100	No	**E-9**	Purple	Purple	Purple	NA	Lt. Brown	Pink	1,600 E (5/11)	9,200 (12/13)	854 gallons injected	● (2)
44-54	Yes	MW-2S	Clear	Clear	Clear	Clear	Clear	Clear	38 (11/12)	51.5 (9/13); 35 (12/13)		● (3)
70-80	Yes	MW-2I	Clear	Pink	Clear	Clear	Clear	Clear	11 (11/12)	NA		● (3)
24-34	Yes	MW-6S	Clear	Clear	Clear	Clear	Clear	Lt. Brown	15 (11/12)	48 (9/13); 27 (12/13)		● (3)
88-98	Yes	MW-6I	Clear	Clear	Clear	Clear	Clear	Lt. Brown	15 (11/12)	30 (9/13); 14 (12/13)		● (3)
36-46	Yes	**MW-10A**	Purple	Brown	Dk. Pink	Lt. Brown	Clear	Lt. Brown	710 (11/12)	210 (12/13)	136 gallons injected	● (3)
65-75	Yes	MW-10B	Clear	Clear	Clear	Clear	Clear	Clear	ND (5/11)	NA		● (3)
104-114	Yes	MW-10C	Pink	Lt. Pink	Lt. Pink	Lt. Brown	Clear	Clear	ND (6/09)	ND (12/13)		● (2)
13-15	Yes	MW-10D	NA	NA	NA	NA	NA	NA	4.1 (5/11)	NA		● (2)
44-54	Yes	**MW-11S**	Purple	Dk. Pink	NA	Lt. Pink	Lt. Pink	Lt. Brown	3,100 (11/12)	3.8 J (9/13); 2,800 (12/13)	136 gallons injected	● (3)
96-106	Yes	MW-11D	Purple	Purple	Purple	Purple	Purple	Purple	370 (11/12)	ND (9/13); 61 (12/13)		● (3)
45-58	Yes	**MW-12S**	Purple	Purple	Purple	Purple	Purple	Purple	1,200 (11/12)	ND (12/13)	177 gallons injected	● (2)
88-98	Yes	MW-12I	Clear	Clear	Clear	Lt. Brown	Lt. Pink	Lt. Pink	22.5 (2/12)	NA		● (2)
20-35	Yes	**MW-13S**	Dk. Pink	Clear	Clear	Clear	Clear	Lt. Brown	300 J (8/12)	480 (9/13); 150 (12/13)	204 gallons injected	● (3)
78-88	Yes	**MW-13I**	Clear	Clear	Pink	Lt. Purple	Clear	Clear	140 (11/12)	NA	136 gallons injected	● (3)
122-132	Yes	MW-13D	NA	NA	NA	NA	NA	NA	0.34 J (5/11)	NA		● (3)
35-50	Yes	MW-14S	NA	NA	NA	NA	NA	NA	0.51 (5/11)	NA		● (3)
98-108	Yes	MW-14I	NA	NA	NA	NA	NA	NA	0.2 J (5/11)	NA		● (3)
155-165	Yes	MW-14D	NA	NA	NA	NA	NA	NA	0.33 J (5/11)	NA		
48-58	Yes	MW-15S	Clear	Clear	Clear	Clear	Clear	Clear	34 (2/12)	NA		● (3)
90-105	Yes	MW-15D	Lt. Pink	Clear	Clear	Clear	Clear	Clear	0.91 (5/11)	NA		● (3)
30-45	Yes	MW-16S	NA	NA	NA	NA	NA	NA	ND (6/09)	NA		● (3)
66-86	Yes	MW-16I	NA	NA	NA	NA	NA	NA	3 (6/09)	NA		● (3)
104-114	Yes	MW-16D	NA	NA	NA	NA	NA	NA	ND (6/09)	NA		● (3)
14-36	Yes	**MW-18S**	Purple	Purple	Purple	Purple	Pink	Pink	540 (2/12)	0.47 J (12/13)	545 gallons injected	● (3)
294-304	Yes	**MW-22D**	Purple	Purple	Purple	Purple	Purple	Purple	260 E (5/11)	NA	110 gallons injected	● (3)
62-72	Yes	MW-23S	NA	NA	NA	NA	NA	NA	23 (2/12)	NA		● (3)
88-98	Yes	MW-23I	NA	NA	NA	NA	NA	NA	3.5 (5/11)	NA		● (3)
36-46	Yes	MW-25S	NA	NA	NA	NA	NA	NA	ND (6/09)	NA		● (3)
35-45	Yes	**MW-28S**	Purple	Clear	Dk. Pink	Pink	Dk. Pink	Lt. Brown	870 (2/12)	500 (12/13)	272 gallons injected	● (3)
55-65	Yes	MW-28I	Clear	Clear	Clear	Clear	Clear	Clear	15 (2/12)	NA		● (3)
19-250	No	GW-9	Clear	Clear	Clear	Clear	Clear	Clear	190 L (4/10)	280 (9/13); 150 (12/13)		● (3)
UNK	No	GW-21	NA	NA	Clear	NA	NA	NA	190 (8/12)	160 (9/13); 73 (12/13)	Total of 9,304 gallons	● (3)

E-1 = Injection Well

NA = Not Evaluated or Not Accessible; ND = Not Detected

(1) Use low flow sampling method for permanganate-influenced wells at the time of sampling or for wells with intervals/screens 30 feet or less (except where noted).

(2) Chloride Test Kit #2 (>20 ppm)

(3) Chloride Test Kit #1 (2-20 ppm)

temperature, and dissolved oxygen. For all open borehole wells, the pump was lowered to or near the most prominent fracture interval where contamination may be present. The pump intake was kept above the bottom of the well. Sample containers were filled by allowing the pump water discharge to flow gently into the container with minimal turbulence.

For each round of performance monitoring, samples were collected from up to 22 wells. Samples were analysed for Target Compound List (TCL) volatile organic compounds (VOCs) using Contract Laboratory Program (CLP) Method SOM01.1 for each round. Table 5 provides the list of the wells monitored. Appendix C provides the analytical data.

TABLE 5
POST-INJECTION GROUNDWATER MONITORING PROGRAM
VALMONT TCE SITE
WEST HAZLETON BOROUGH AND HAZLE TOWNSHIP, PENNSYLVANIA

WELL	PROCESS	PERFORMANCE[2]	COMMENTS [1]
E-1	▲	▲	Round 2 Injection Well
E-2	▲	▲	Round 2 Injection Well
E-3	▲	▲	Round 2 Injection Well
E-4	▲	▲	Round 2 Injection Well
E-5	▲	▲	Round 2 Injection Well
E-6	▲	▲	Round 2 Injection Well
E-7	▲	▲	Round 2 Injection Well
E-8	--	▲	
E-9	▲	▲	Round 2 Injection Well
2S	▲	▲	
2I	▲	--	
6S	▲	▲	
6I	▲	▲	
10A	▲	▲	Round 2 Injection Well
10B	▲	--	
10C	▲	▲	
11S	▲	▲	Round 2 Injection Well
11D	▲	▲	Round 2 Injection Well
12S	▲	▲	Round 2 Injection Well
12I	▲	--	
13S	▲	▲	Round 2 Injection Well
13I	▲	--	Round 2 Injection Well
15S	▲	--	
15D	▲	--	
18S	▲	▲	Round 2 Injection Well
22D	▲	▲	Round 2 Injection Well
28S	▲	▲	Round 2 Injection Well
28I	▲	--	
GW-21	--	▲	
GW-9	▲	▲	
TOTALS	28	23	Plus QA/QC samples

Notes: [1] Selected wells containing the presence of permanganate during monitoring may be sampled at the direction of EPA.
[2] All performance samples were analyzed for VOCs.

5.0 POST-INJECTION MONITORING RESULTS

In September 2013, one round of performance monitoring was completed after three months of the Round 2 ISCO injections; a second round was performed in December 2013 after five months. Groundwater samples were taken from a network of wells throughout the Site to help evaluate the impact of the injections on VOC concentrations throughout the plume. Samples were analyzed for TCL VOCs. The analytical results were compared to baseline sampling events conducted between May 2009 and November 2012. Figures 2 and 3 reflect the TCE concentrations obtained during the December performance monitoring event for shallow and deeper groundwater, respectively. For wells that were not sampled in 2013, the most recent analytical data were used instead. Note that this approach may not adequately reflect current groundwater contaminant concentrations.

The shallow groundwater monitoring analytical results indicated that the overall TCE plume shape, as indicated by the 10 micrograms per liter (µg/L) contour (Figure 2), was similar to the configuration of the plume prior to Round 2 injections. However, the areas of maximum concentrations (the contaminant mass) in both the source area (in the vicinity of the Plant and north parking lot) and in the down gradient residential area to the north have decreased. The ISCO injections have reduced the areas of higher concentration and shrunk the plume width at the property boundary to the north. The shape of the plume has not changed appreciably to the south.

For the shallow plume, the highest TCE concentrations in December 2013 continued to be located near well MW-11S and E-9. The maximum TCE concentration detected was for E-9 (9,200 µg/L), followed by MW-11S (2,800 µg/L), MW-28S (500 µg/L), E-2 (450 µg/L), E-4 (250 µg/L), MW-10A (210 µg/L), E-8 (165 µg/L), MW-13S (150 µg/L) and GW-9 (150 µg/). All other results were below 100 µg/L.

Figure 4 shows the graphical plots of shallow groundwater TCE concentrations in selected monitoring wells between 2008 and 2013. In many cases, the TCE concentrations initially decreased after injections and then TCE levels rebounded to varying degrees. There was no clear correlation between the magnitude of the concentration rebound and monitoring well location or pre-injection concentrations. These trends suggested that the ISCO injections have not yet reached the entire VOC contaminant mass. This may be due to various hydrogeological and engineering factors, such as matrix porosity, matrix organic carbon, fracture aperture, ISCO dosage, temporary mass displacement and hydraulic gradient that affect advective transport and matrix diffusion of the oxidant material injected.

Based on TCE trends for shallow groundwater (Figure 4), a long term decrease in concentration from 2009 to 2012 was observed in MW-6S. Wells that had significant initial decreases in concentrations followed by rebound to TCE concentrations similar to or exceeding the baseline levels included MW-10A,

MW-13S, MW-15S, MW-23S, and MW-28S. Concentrations in well MW-11S rebounded to higher TCE levels after both sets of injections, so that MW-11S now contains the highest TCE concentration for shallow groundwater (based on the December 2013 groundwater analytical results). This increase corresponded to an even larger decrease in the TCE level for well MW-11D, indicating that contaminated groundwater may have been forced upward, outward, or both during injections.

Sodium and potassium permanganate are oxidants, so an increase in ORP values may indicate impacts from ISCO injections. ORP values in the shallow groundwater (Figure 5) tended to increase after injection, although this process may have been delayed or attenuated in the wells further from the injection areas, such as well MW-7S.

For the deeper plume, the highest TCE concentration was detected in well E-4 (1,200J µg/L as reported in August 2012). Other elevated TCE levels greater than 250 µg/L were detected in wells MW-11D (370 µg/L) and MW-22D (260E µg/L as reported in 2011).

Deeper groundwater TCE concentrations were generally higher than shallow groundwater TCE levels. The deep groundwater TCE results indicated that the contaminant mass in the northern plume has significantly decreased with a much smaller overall plume (as defined by the 10 µg/L contour, Figure 3) and significantly lower concentrations at individual wells, resulting in a reduced plume mass in the residential area. In the source area, the maximum concentrations and the total contaminant mass have decreased dramatically. However, the plume south of the groundwater divide has not changed significantly in terms of plume shape or contaminant mass.

Figure 6 displays the trends for TCE deeper groundwater concentrations in selected monitoring wells. For deeper groundwater, TCE levels decreased after Round 2 injections and, generally, showed little or no post-injection rebound. The locations where rebound did occur, as in wells MW-13I and MW-28I, may be indicative of a greater hydraulic connection between shallow and intermediate depth portions of the contaminant plume. The TCE concentrations also decreased in the deeper groundwater after the 2009 Pilot Study and Round 1 2011 injections.

Based on TCE trends for deeper groundwater (Figure 6), many wells containing elevated TCE concentrations were affected by the injections. Wells exhibiting significant TCE decreases after injections and minimal rebound included GW-21, GW-23, MW-6I, and MW-11D. Wells indicating apparent rebound included MW-6I, MW-13I, and MW-28I. ORP trends for deeper groundwater (Figure 7) indicated strong impact on two wells (MW-10B and E-2) that had significant increases in concentration. Other wells had ORP fluctuations over time without a direct correlation to TCE concentrations.

6.0 PROPOSED ROUND 3 ISCO INJECTION APPROACH

Appendix D provides the proposed approach for the next round of ISCO injections (i.e., Round 3) based on current TCE and other VOC concentrations, PIM results, and past ISCO injection events. This approach recommends the injection of more than 19,000 gallons of oxidant solution into up to 12 wells. Tetra Tech has not proposed well E-9 as part of this round. EPA may wish to evaluate the use of well E-8 as a viable injection well.

7.0 LESSONS LEARNED

The following is a list of lessons learned from the second round of ISCO injections:

1. Several of the low-pressure hoses failed during injections at the site. For future injection activities, all injections hoses should be tested and certified to meet expected injection pressures as specified in the scope of work. Certification of the hoses should be supplied prior to site activities.

2. Spill containment pads should be installed under or around any permanganate transfer hoses/piping which may need to be disconnected during injection activities. Mortar tubs/Kiddie pools where available and supplied to the subcontractor for use as spill containment pads to prevent spills to the ground surface.

3. Several proposed injection well intervals were not suitable for the low-pressure (up to 125 psi) injections. Injections at these wells/zones were not successful. In the future, optional injection zones/intervals should be selected and listed within the work plans and or scope of work. This will help with decision making and save time in the field.

4. Portable lighting should be made available for any work conducted inside the Plant. The majority of the building lights were non-operational and the areas around wells MW-18 and E-6 were very dark. Tetra Tech purchased several portable light stands for use by the subcontractor during indoor injection activities.

8.0 REFERENCES

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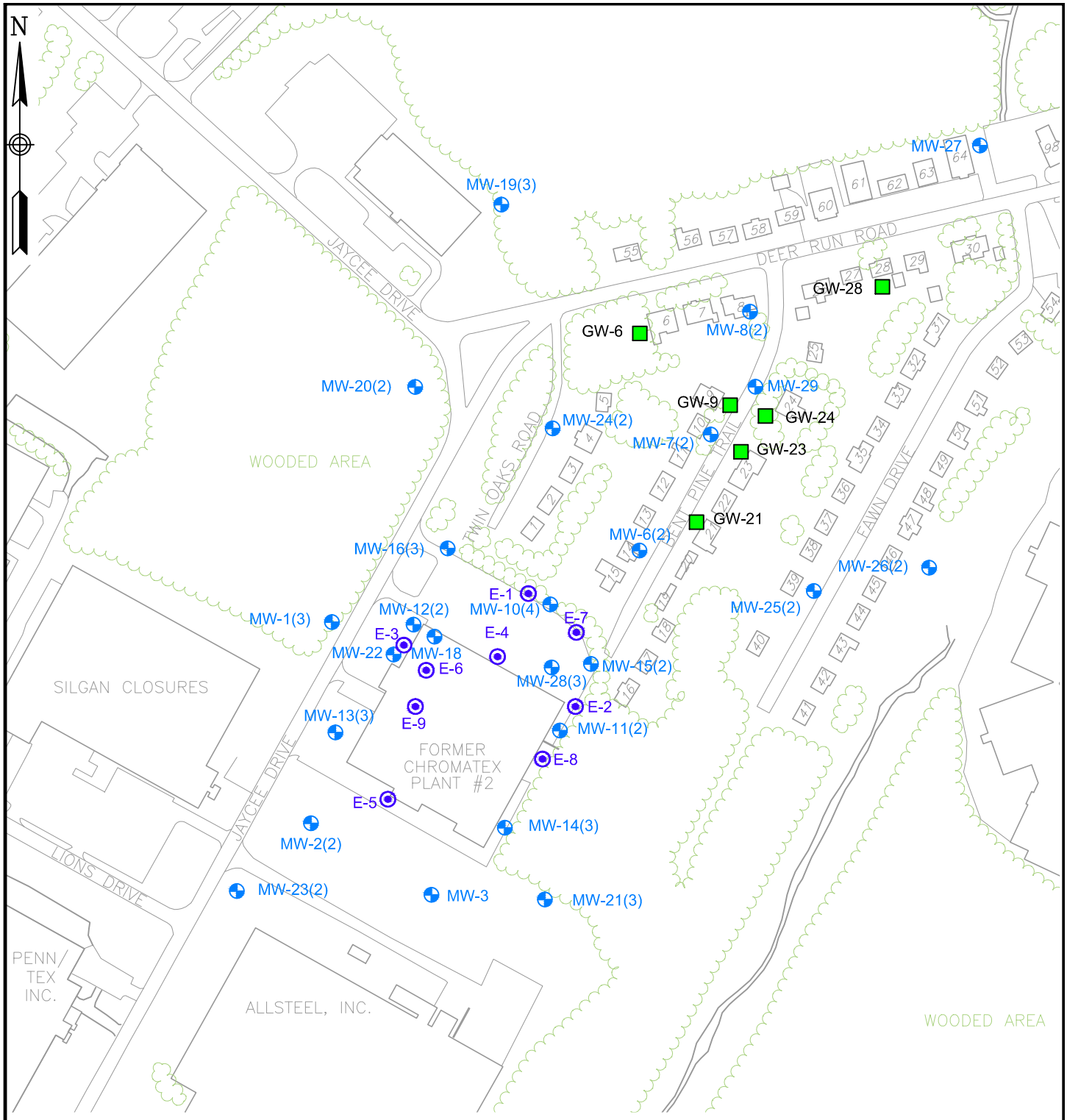
FIGURES



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

EXISTING WELL NETWORK
VALMONT TCE SITE
HAZLE TOWNSHIP AND
WEST HAZLETON BOROUGH
LUZERNE COUNTY, PENNSYLVANIA

SCALE	AS NOTED
FILE	112G03485GM12
REV	0
DATE	05/15/13
FIGURE NUMBER	FIGURE 1

112G03485\1120\112G03485GM17.DWG 02/10/14 MKB

N

JAYCEE DRIVE

DEER RUN ROAD

TWIN OAKS ROAD

BENT PINE TRAIL

FAWN DRIVE

ND (2009)
MW-19S

MW-8S
26 (2011)

ND (2009)
MW-20S

73 E (2011)
MW-29

0.63 B (2010)
MW-24S

MW-7S
210 E (2011)

MW-16S
0.49 J (2009)

27
MW-6S

E-1

MW-10A
210

0.18 J (2009)
MW-1A

ND
MW-12S

ND
MW-18S

E-3

E-4

E-7
190

MW-28S
500

MW-15S
34 (2012)

E-6

E-2
450

9,200(?)
E-9

150
MW-13S

FORMER
CHROMATEX
PLANT #2

MW-11S
2,800

E-8

19
E-5

35
MW-2S

MW-14S
0.51 (2011)

ND (2009)
MW-25S

ND (2009)
MW-26S

MW-23S
23 (2012)

ND (2009)
MW-3

ND (2011)
MW-21S

10
100
250
500
1,000

SILGAN
CLOSURES

ALLSTEEL INC.

WOODED AREA

LEGEND

- MONITORING WELL
- INJECTION WELL
- PRESENCE OF PERMANGANATE
- RESIDENTIAL WELL
- 25 RESIDENCE
- GROUNDWATER DIVIDE
- 10 TCE CONTOUR (ug/L) (DASHED WHERE INFERRED)
- 250 TCE CONCENTRATION
- ND NON-DETECT
- J,E ANALYTE PRESENT, MAY NOT BE ACCURATE OR PRECISE
- K VALUE MAY BE BIASED HIGH
- B BLANK CONTAMINATION

0 150 300
SCALE IN FEET

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DECEMBER 2013 SHALLOW GROUNDWATER MONITORING RESULTS VALMONT TCE SITE HAZLE TOWNSHIP AND WEST HAZLETON BOROUGH LUZERNE COUNTY, PENNSYLVANIA

SCALE
AS NOTED

REV
0

DATE
02/10/14

FILE
112G03485GM17

FIGURE NUMBER
FIGURE 2

112G03485\1120\112G03485GM18.DWG 02/10/14 MKB

N

JAYCEE DRIVE

DEER RUN ROAD

TWIN OAKS ROAD

BENT PINE TRAIL

FAWN DRIVE

ALLSTEEL INC.

WOODED AREA

FORMER CHROMATEX PLANT #2

ND (2009)
MW-19I
MW-19D
ND (2009)

0.25 J (2009)
MW-27

GW-28
12 (2011)

3.9 (2011)
MW-8D

4.1 (2003)
GW-06

ND (2009)
MW-20D

ND (2009)
MW-24I

86 (2011)
155
GW-09
GW-24

MW-7I
36 E (2011)
120 (2011)
GW-23

73
GW-21

1.9 (2009)
MW-16I
MW-16D
ND (2009)

14
MW-6I

ND (2009)
MW-26I

ND (2009)
MW-25I

ND
E-1
MW-10C
MW-10B
ND (2011)

0.15 (2009)
MW-1B
0.5 B (2009)
MW-1C

MW-12I
22.5 (2013)

15 (2013)
MW-28I

190
E-7

E-3
MW-22D
260 E (2011)

250
E-4

E-6

MW-15D
0.91 (2011)

MW-28D
ND (2009)

9,200 (?)
E-9

E-2
450

MW-11D
61

MW-13I
370 (2013)

165
E-8

E-5
19

MW-2I
11 (2012)

MW-14D 0.33 J (2011)
MW-14I 0.2 J (2011)

MW-23I
3.5 (2011)

ND (2011)
MW-21I
MW-21D
ND (2011)

10
50
100

LEGEND

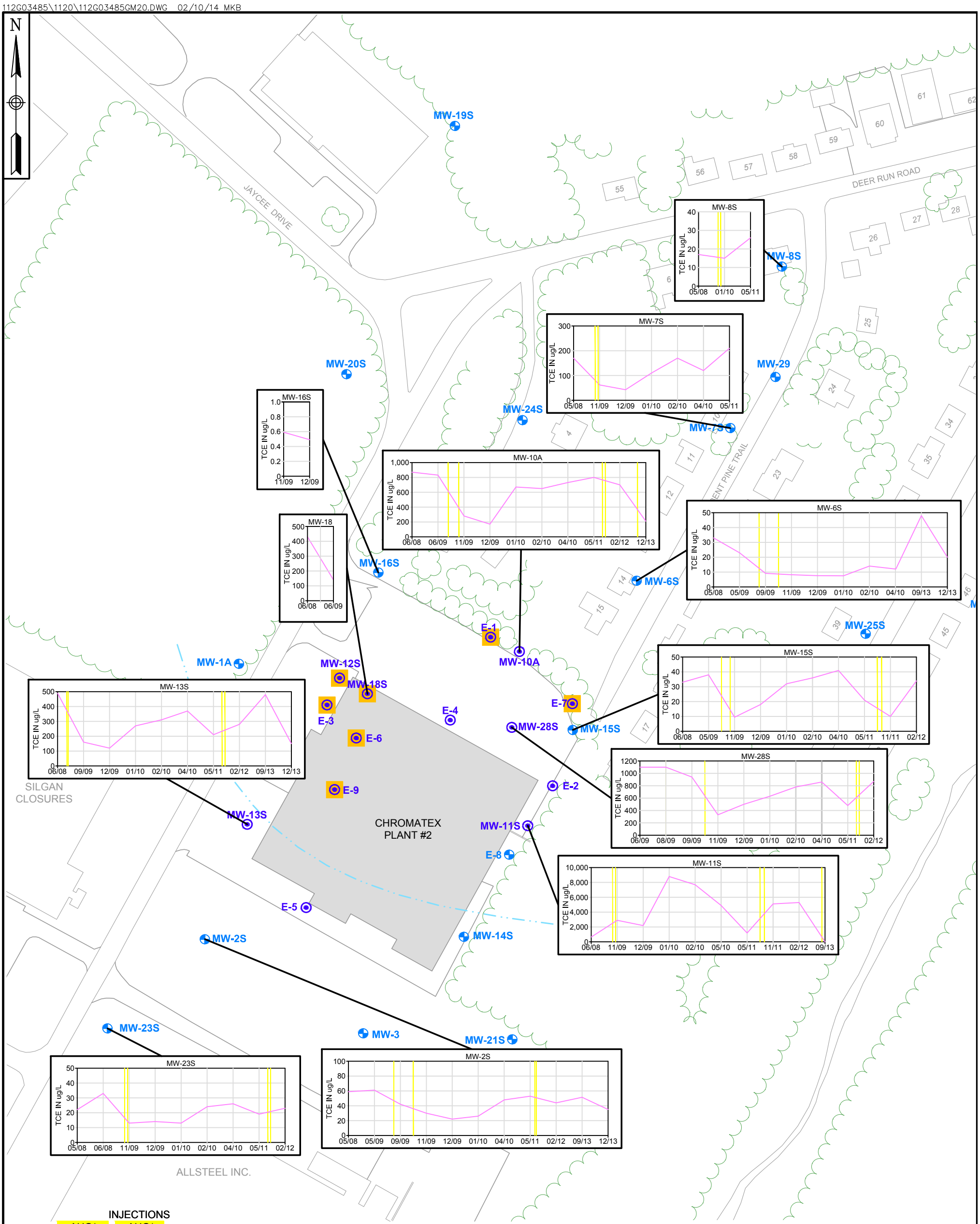
- MONITORING WELL
- INJECTION WELL
- PRESENCE OF PERMANGANATE
- RESIDENTIAL WELL
- 25 RESIDENCE
- GROUNDWATER DIVIDE
- 10 TCE CONTOUR (ug/L) (DASHED WHERE INFERRED)
- 250 TCE CONCENTRATION
- ND NON-DETECT
- J,E ANALYTE PRESENT, MAY NOT BE ACCURATE OR PRECISE
- K VALUE MAY BE BIASED HIGH
- B BLANK CONTAMINATION
- L ANALYTE PRESENT, REPORTED VALUE MAY BE BIASED LOW.

0 150 300
SCALE IN FEET

DECEMBER 2013 DEEPER GROUNDWATER MONITORING RESULTS VALMONT TCE SITE HAZLE TOWNSHIP AND WEST HAZLETON BOROUGH LUZERNE COUNTY, PENNSYLVANIA

SCALE: AS NOTED
REV: 0
DATE: 02/10/14
FILE: 112G03485GM18
FIGURE NUMBER: FIGURE 3

112G03485\1120\112G03485GM20.DWG 02/10/14 MKB



INJECTIONS

WELL	AUG/ OCT 2009	AUG/ SEP 2011	MAY 2013
E-1	X		X
E-2	X		X
E-3	X		X
E-4	X		X
E-5	X	X	X
E-6	X		X
E-7		X	X
E-8		X	
E-9		X	X
MW-10A			X
MW-11S			X
MW-12S			X
MW-13S			X
MW-13I			X
MW-18S			X
MW-22D			X
MW-28S			X

NOTES:
1. INJECTIONS TOOK PLACE BETWEEN AUGUST & OCTOBER 2009 AND BETWEEN AUGUST & SEPTEMBER 2011 AND IN MAY 2013.
2. TCE MEASURED IN MICROGRAMS/ LITER (ug/L).

LEGEND

- MONITORING WELL
- INJECTION WELL
- PRESENCE OF PERMANGANATE
- 25 RESIDENCE
- GROUNDWATER DIVIDE

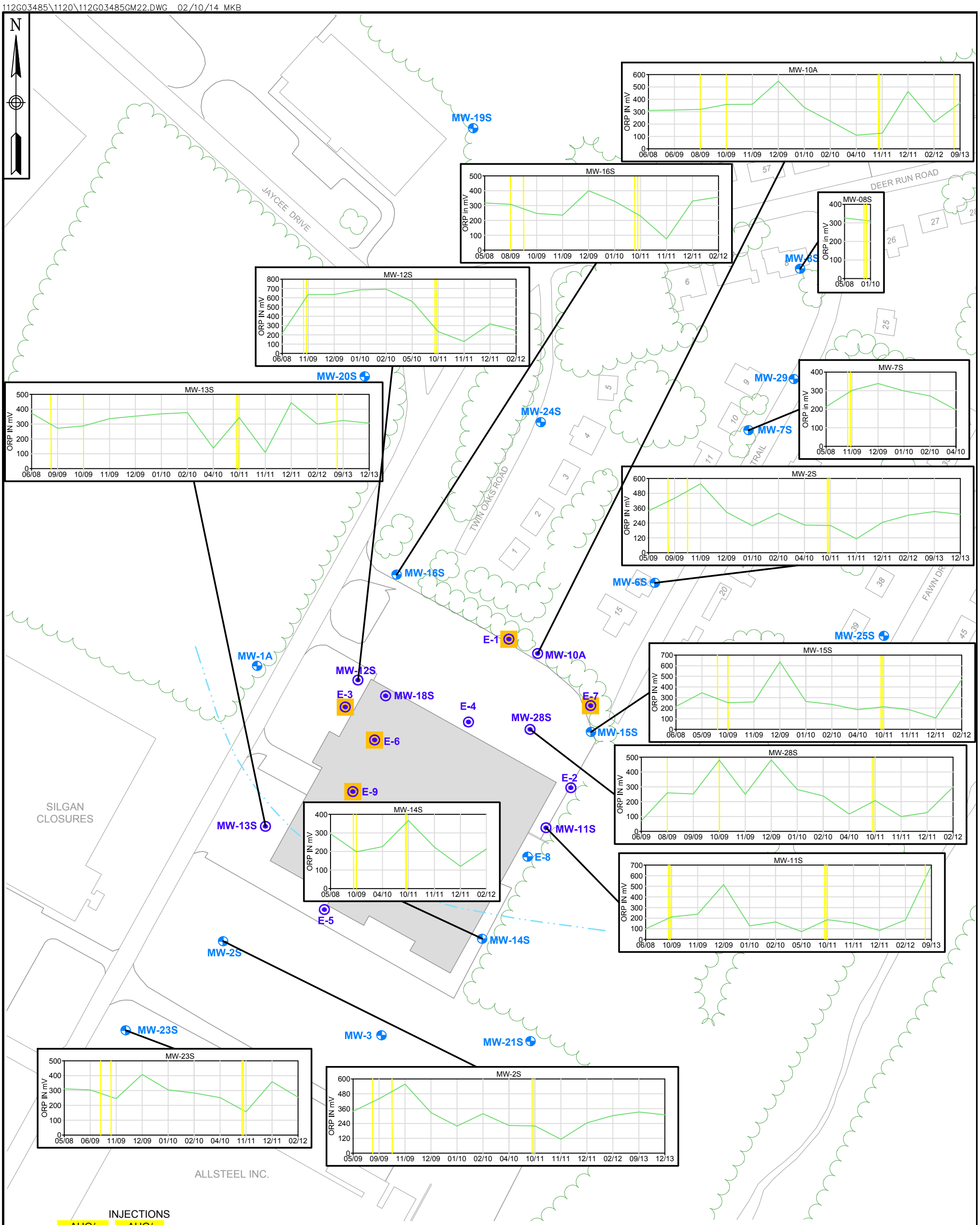
0 150 300
SCALE IN FEET

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

TCE CONCENTRATION TRENDS FOR SHALLOW GROUNDWATER VALMONT TCE SITE HAZLE TOWNSHIP AND WEST HAZLETON BOROUGH LUZERNE COUNTY, PENNSYLVANIA

SCALE: AS NOTED
REV: 0
DATE: 02/10/14
FILE: 112G03485GM20
FIGURE NUMBER: FIGURE 4

112G03485\1120\112G03485GM22.DWG 02/10/14 MKB



INJECTIONS

WELL	AUG/ OCT 2009	AUG/ SEP 2011	MAY 2013
E-1	X		X
E-2	X		X
E-3	X		X
E-4	X		X
E-5	X	X	X
E-6	X		X
E-7		X	X
E-8		X	
E-9		X	X
MW-10A			X
MW-11S			X
MW-12S			X
MW-13S			X
MW-13I			X
MW-18S			X
MW-22D			X
MW-28S			X

NOTES:
1. INJECTIONS TOOK PLACE BETWEEN AUGUST & OCTOBER 2009 AND BETWEEN AUGUST & SEPTEMBER 2011 AND IN MAY 2013.
2. TCE MEASURED IN MICROGRAM/ LITER (ug/L).

LEGEND

- MONITORING WELL
- INJECTION WELL
- PRESENCE OF PERMANGANATE
- 25 RESIDENCE
- GROUNDWATER DIVIDE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

ORP TRENDS FOR SHALLOW GROUNDWATER VALMONT TCE SITE HAZLE TOWNSHIP AND WEST HAZLETON BOROUGH LUZERNE COUNTY, PENNSYLVANIA

SCALE: AS NOTED

REV: 0 DATE: 02/10/14

FILE: 112G03485GM22

FIGURE NUMBER: FIGURE 5

112G03485\1120\112G03485GM19.DWG 02/10/14 MKB

N

JAYCEE DRIVE

DEER RUN ROAD

BENT PINE TRAIL

FAWN DRIVE

MW-27

MW-19I
MW-19D

MW-8D

GW-06

GW-28

GW-21

GW-9

MW-20D

GW-24

GW-09

MW-24I

MW-7I

GW-23

MW-6I

MW-16I
MW-16D

MW-26I

E-1
MW-10B
MW-10C

MW-25I

MW-1B
MW-1C

MW-12I

E-3
MW-22D

E-4

MW-28I

E-7

MW-15D

E-6

CHROMATEX
PLANT #2

E-2

E-9

MW-11D

MW-13I
MW-13D

E-8

E-5

MW-2I

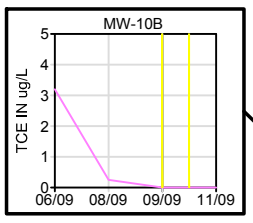
MW-14D
MW-14I

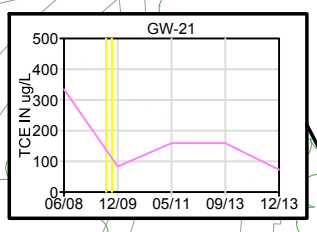
MW-23I

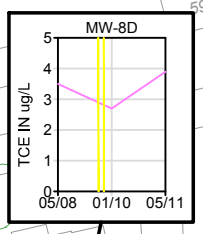
MW-21I
MW-21D

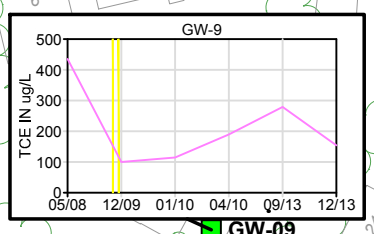
WOODED AREA

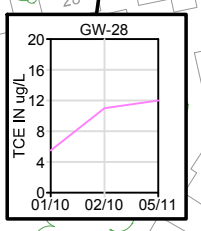
ALLSTEEL INC.

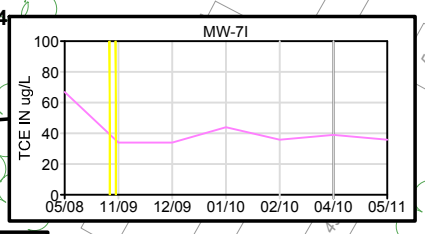


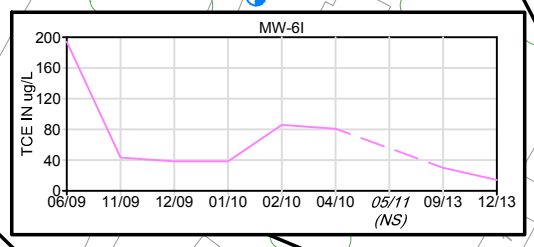


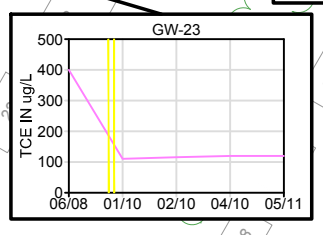


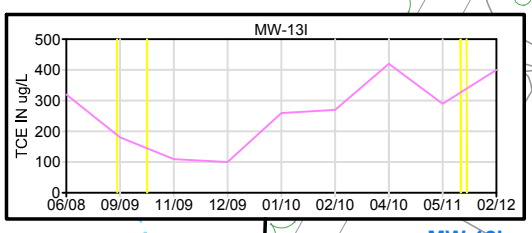


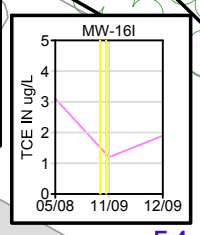


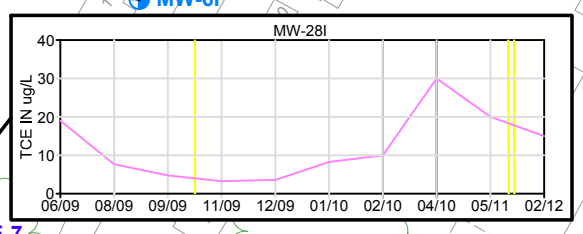


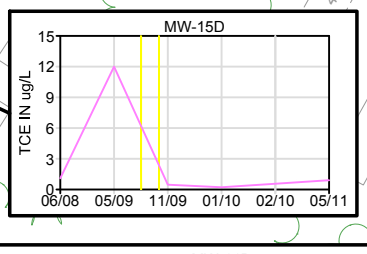


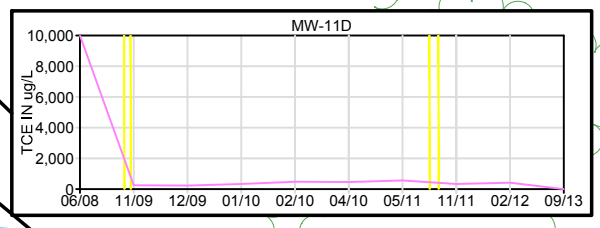


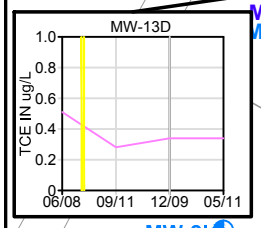


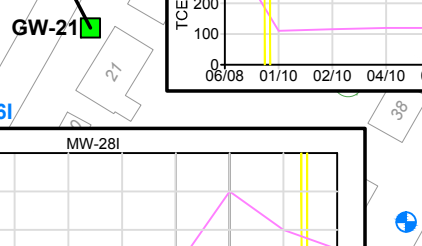


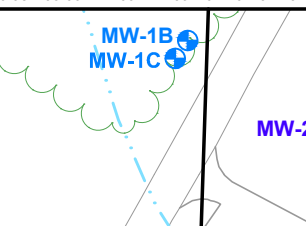


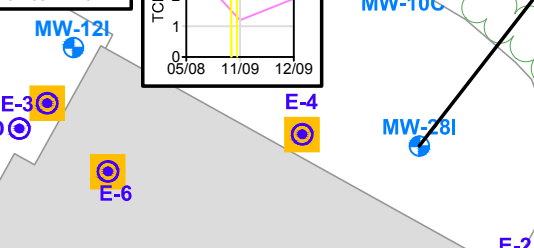


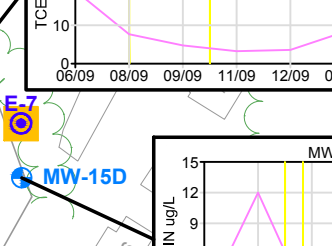












INJECTIONS

WELL	AUG/ OCT 2009	AUG/ SEP 2011	MAY 2013
E-1	X		X
E-2	X		X
E-3	X		X
E-4	X		X
E-5	X	X	X
E-6	X		X
E-7		X	X
E-8		X	
E-9		X	X
MW-10A			X
MW-11S			X
MW-12S			X
MW-13S			X
MW-13I			X
MW-18S			X
MW-22D			X
MW-28S			X

NOTES:
1. INJECTIONS TOOK PLACE BETWEEN AUGUST & OCTOBER 2009 AND BETWEEN AUGUST & SEPTEMBER 2011 AND IN MAY 2013.
2. TCE MEASURED IN MICROGRAMS/ LITER (ug/L).

LEGEND

- MONITORING WELL
- INJECTION WELL
- PRESENCE OF PERMANGANATE
- 25 RESIDENCE
- GROUNDWATER DIVIDE

0 150 300
SCALE IN FEET

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

TCE CONCENTRATION TRENDS FOR DEEPER GROUNDWATER VALMONT TCE SITE HAZLE TOWNSHIP AND WEST HAZLETON BOROUGH LUZERNE COUNTY, PENNSYLVANIA

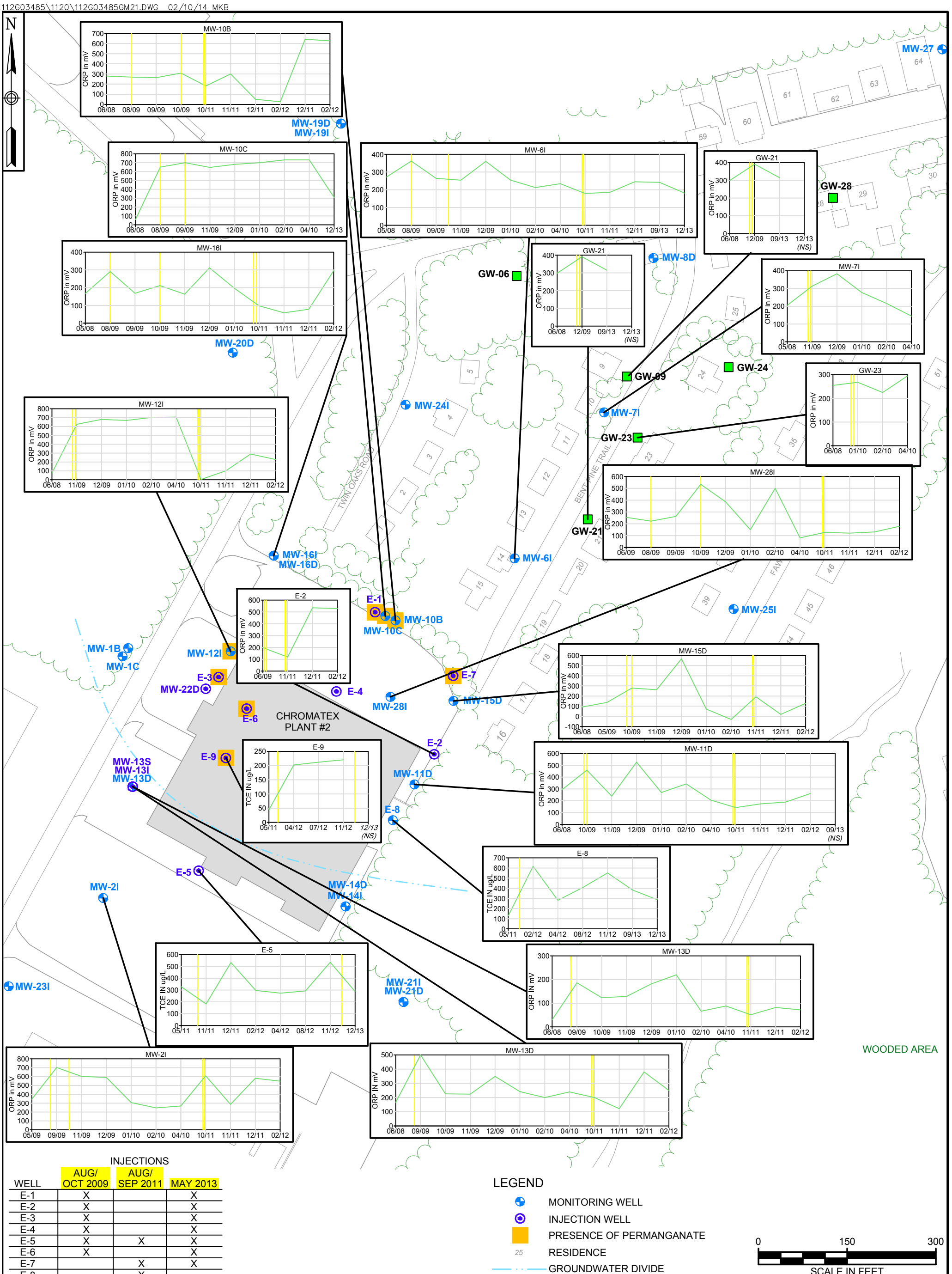
SCALE
AS NOTED

REV 0
DATE 02/10/14

FILE
112G03485GM19

FIGURE NUMBER
FIGURE 6

112G03485\1120\112G03485GM21.DWG 02/10/14 MKB



INJECTIONS

WELL	AUG/ OCT 2009	AUG/ SEP 2011	MAY 2013
E-1	X		X
E-2	X		X
E-3	X		X
E-4	X		X
E-5	X	X	X
E-6	X		X
E-7		X	X
E-8		X	
E-9		X	X
MW-10A			X
MW-11S			X
MW-12S			X
MW-13S			X
MW-13I			X
MW-18S			X
MW-22D			X
MW-28S			X

NOTES:
1. INJECTIONS TOOK PLACE BETWEEN AUGUST & OCTOBER 2009 AND BETWEEN AUGUST & SEPTEMBER 2011 AND IN MAY 2013.
2. TCE MEASURED IN MICROGRAMS/ LITER (ug/L).

LEGEND

- MONITORING WELL
- INJECTION WELL
- PRESENCE OF PERMANGANATE
- 25 RESIDENCE
- GROUNDWATER DIVIDE

0 150 300
SCALE IN FEET

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

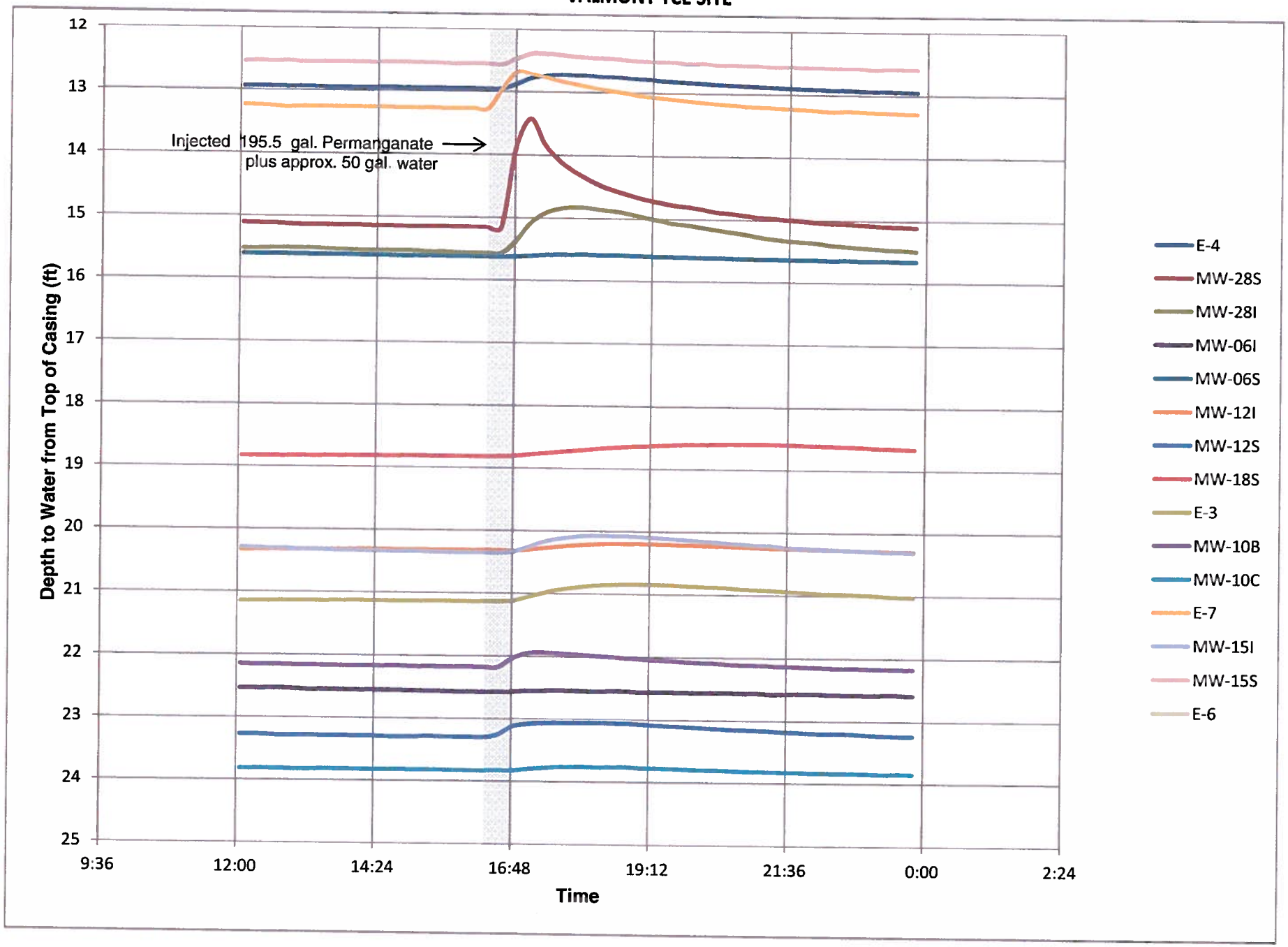
ORP TRENDS FOR DEEPER GROUNDWATER VALMONT TCE SITE HAZLE TOWNSHIP AND WEST HAZLETON BOROUGH LUZERNE COUNTY, PENNSYLVANIA

SCALE: AS NOTED
REV: 0
DATE: 02/10/14
FILE: 112G03485GM21
FIGURE NUMBER: FIGURE 7

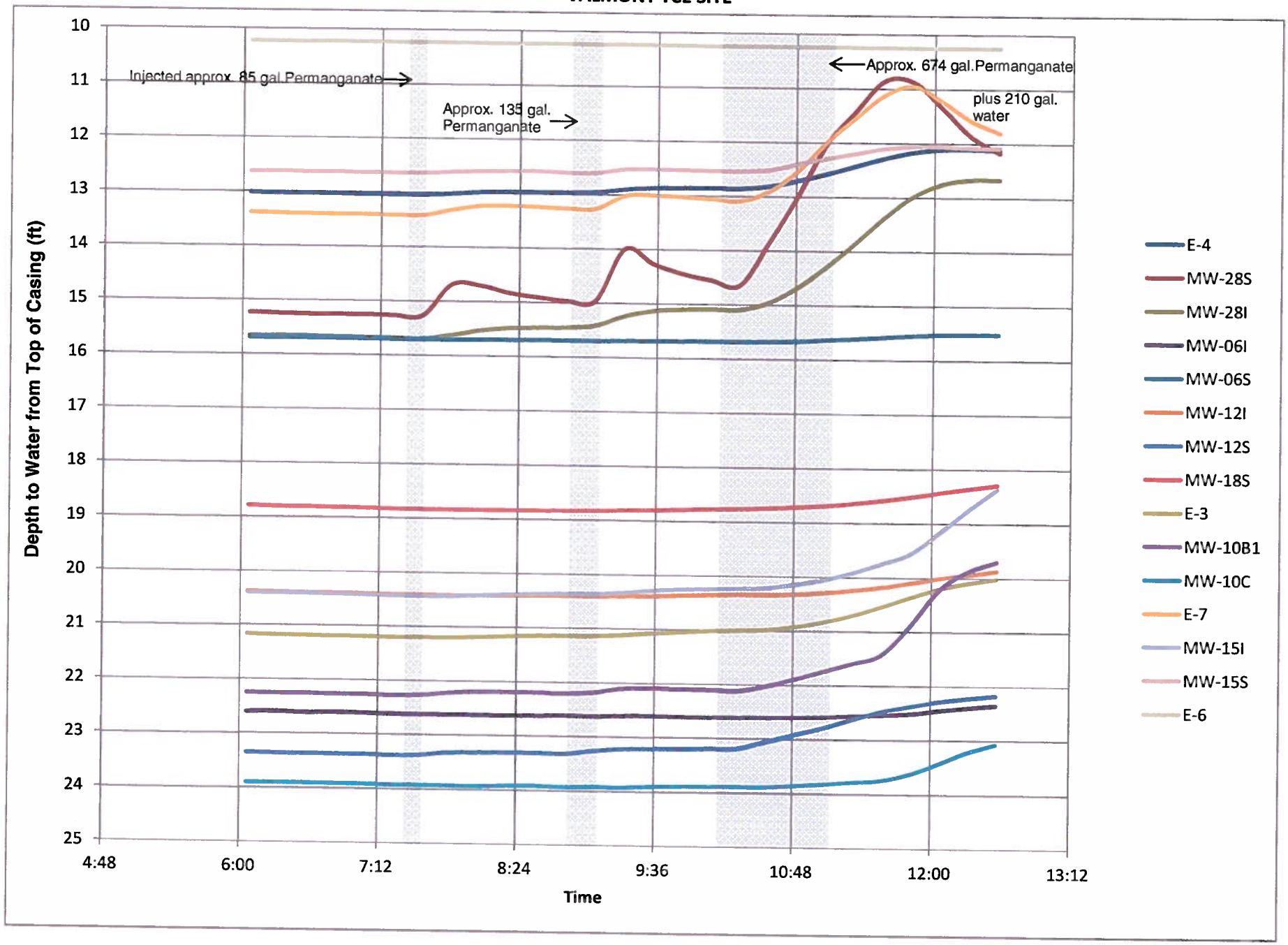
APPENDIX A

PRESSURE TRANSDUCER DATA

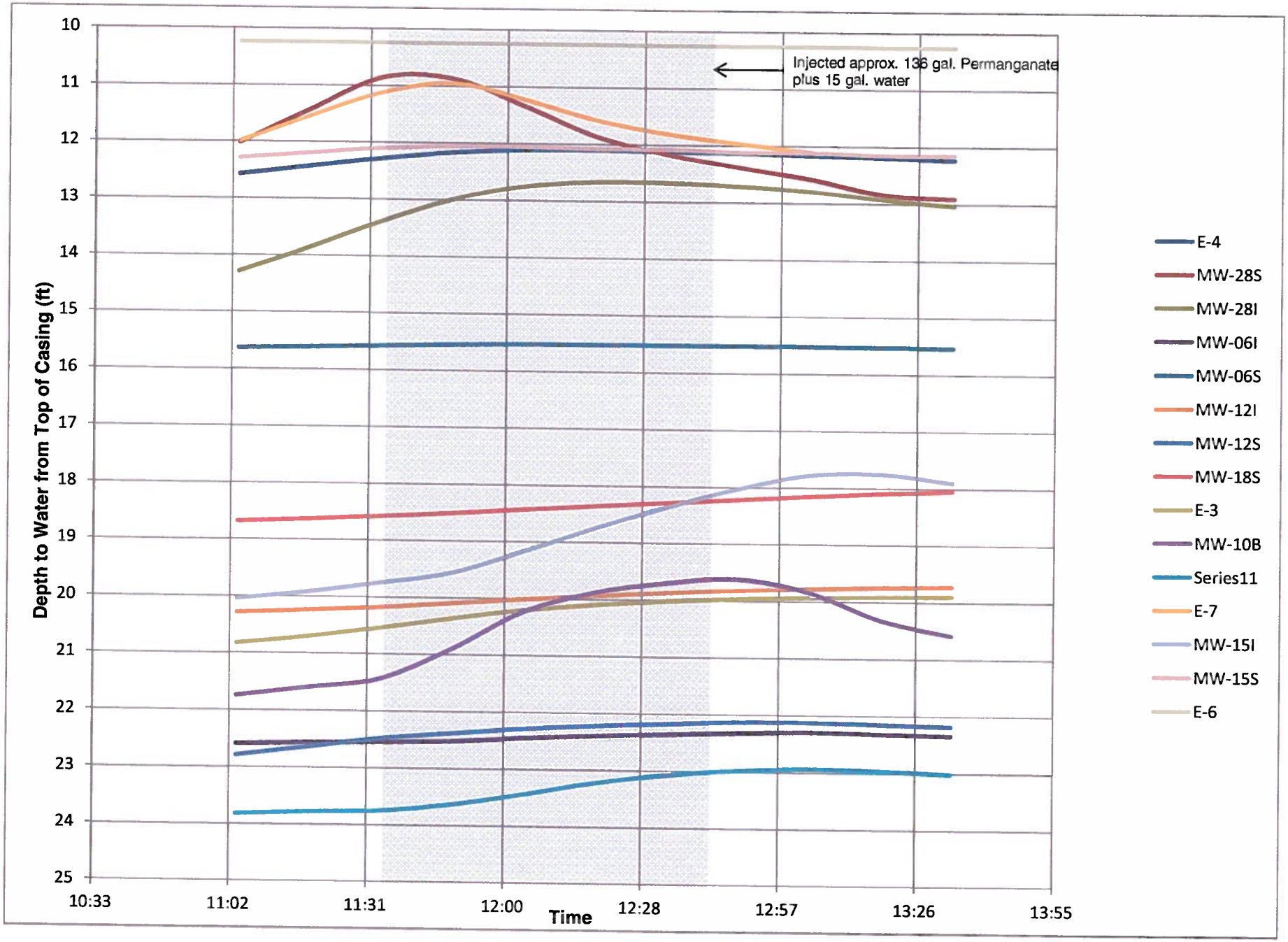
E-1 INJECTION (20 FT - 40 FT ZONE)
MAY 20, 2013
VALMONT TCE SITE



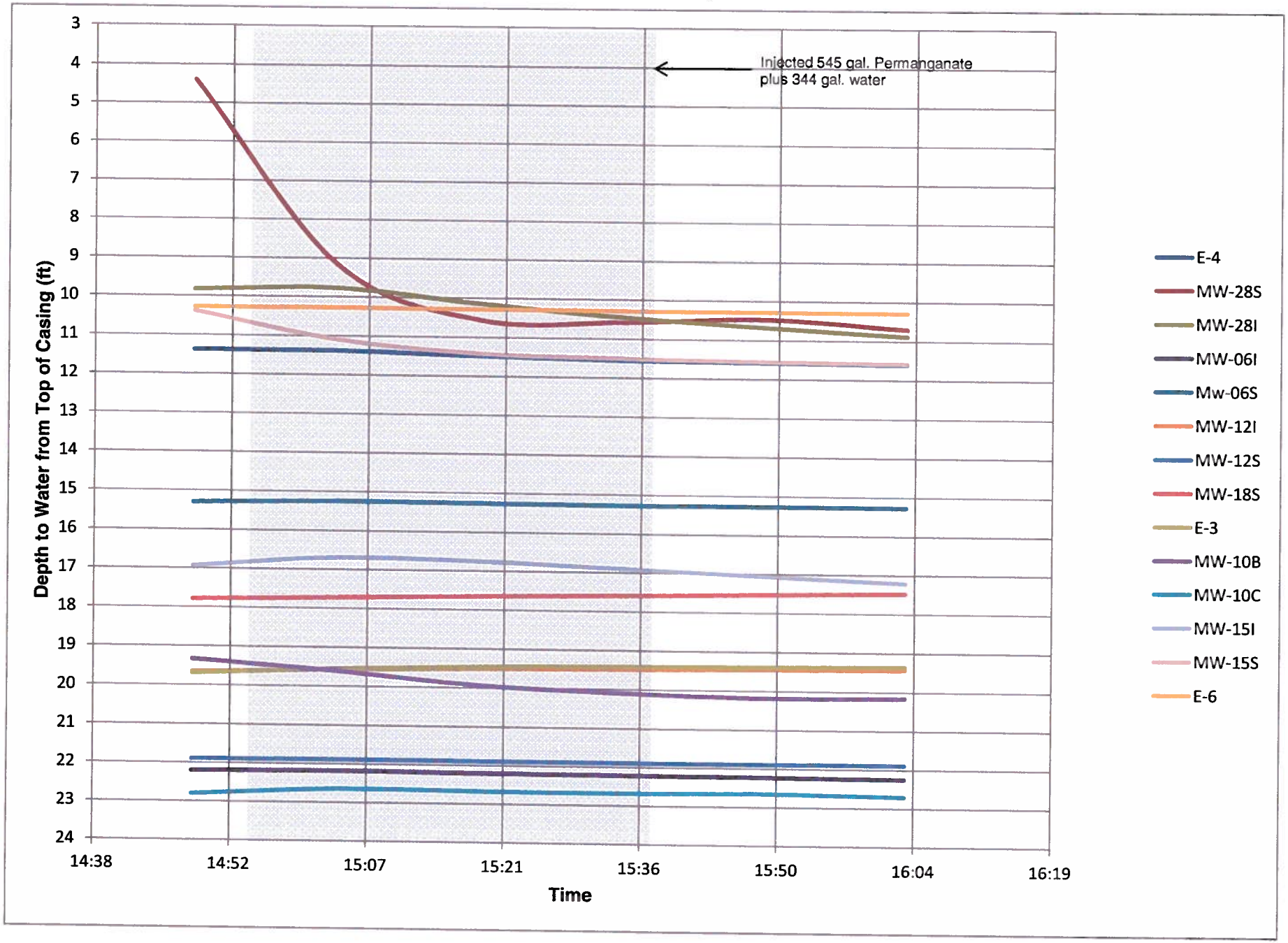
E-1 INJECTION (20 FT - 40 FT ZONE)
MAY 21, 2013
VALMONT TCE SITE



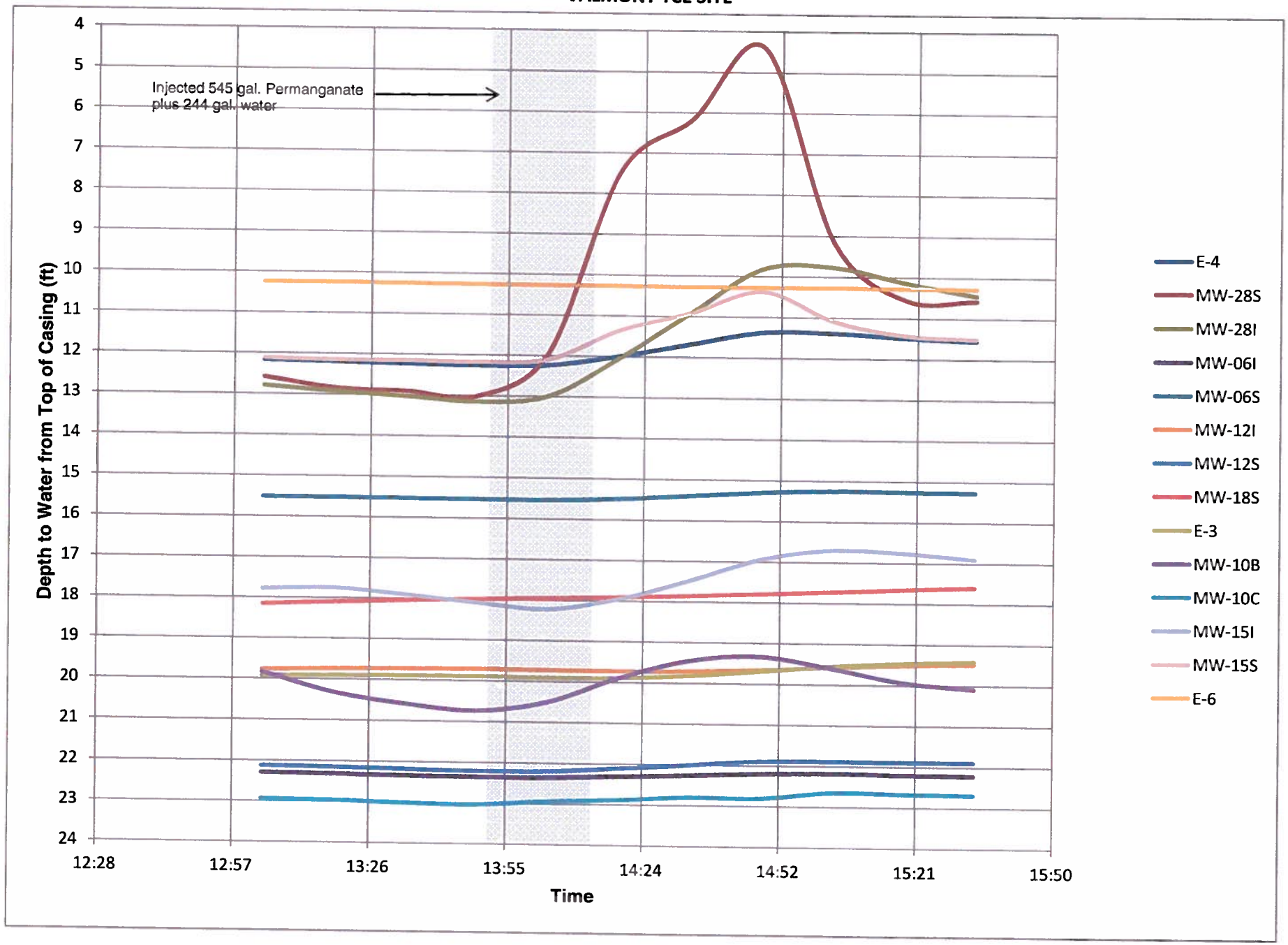
MW-10A INJECTION (36 FT - 46 FT ZONE)
MAY 21, 2013
VALMONT TCE SITE



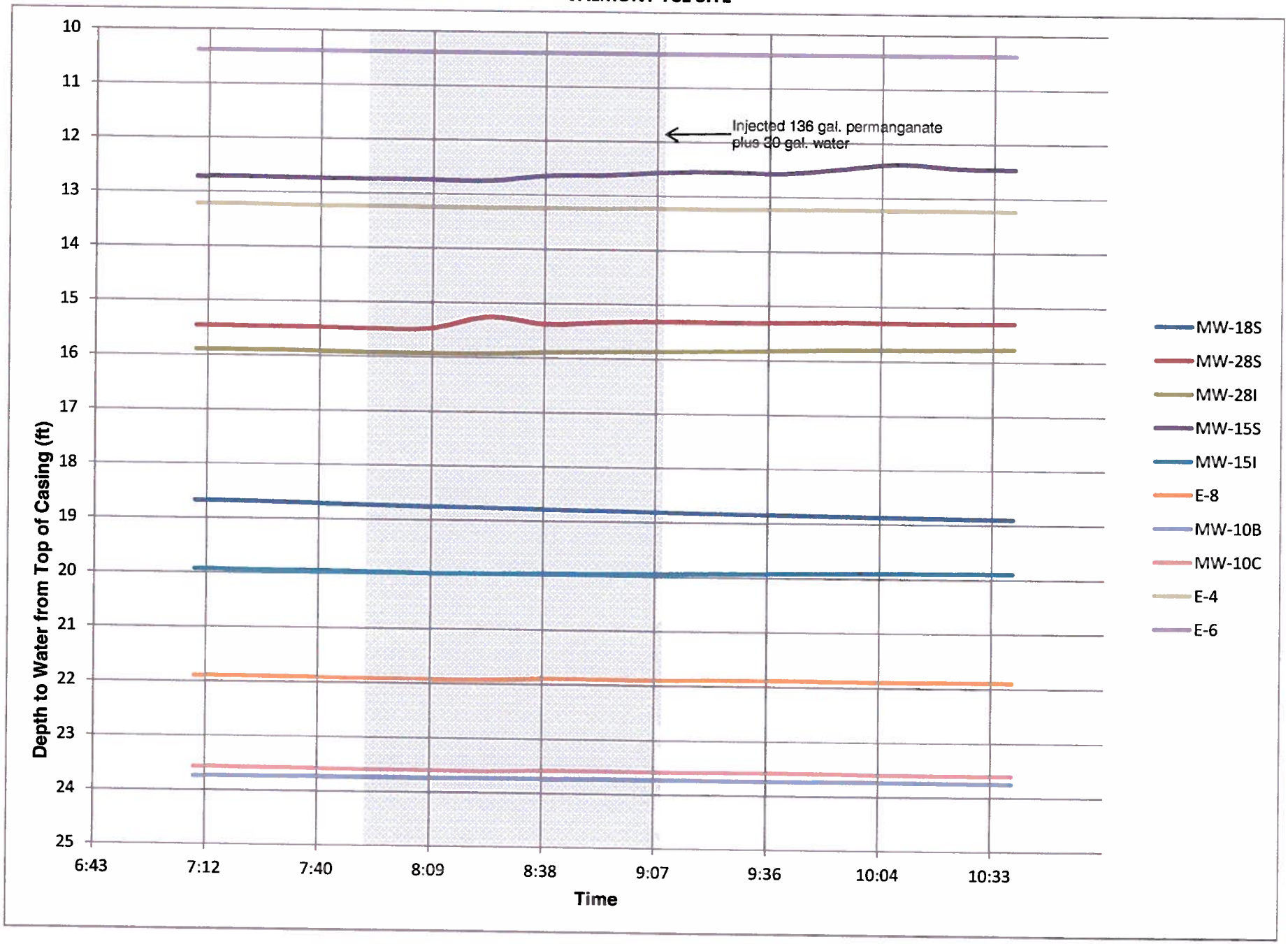
E-7 INJECTION (18 FT- 38 FT ZONE)
MAY 21, 2013
VALMONT TCE SITE



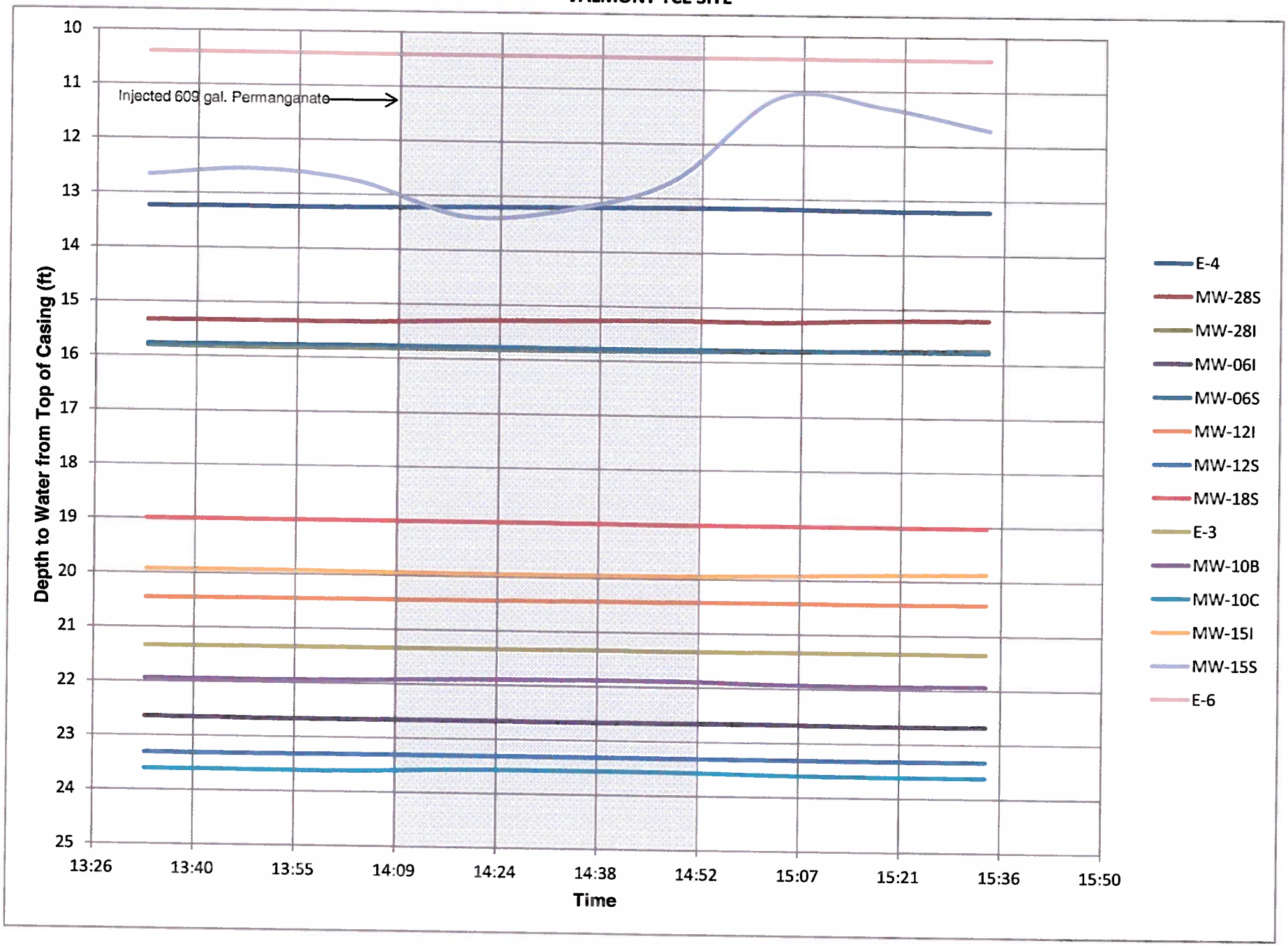
E-7 INJECTION (40 FT- 60 FT ZONE)
MAY 21, 2013
VALMONT TCE SITE



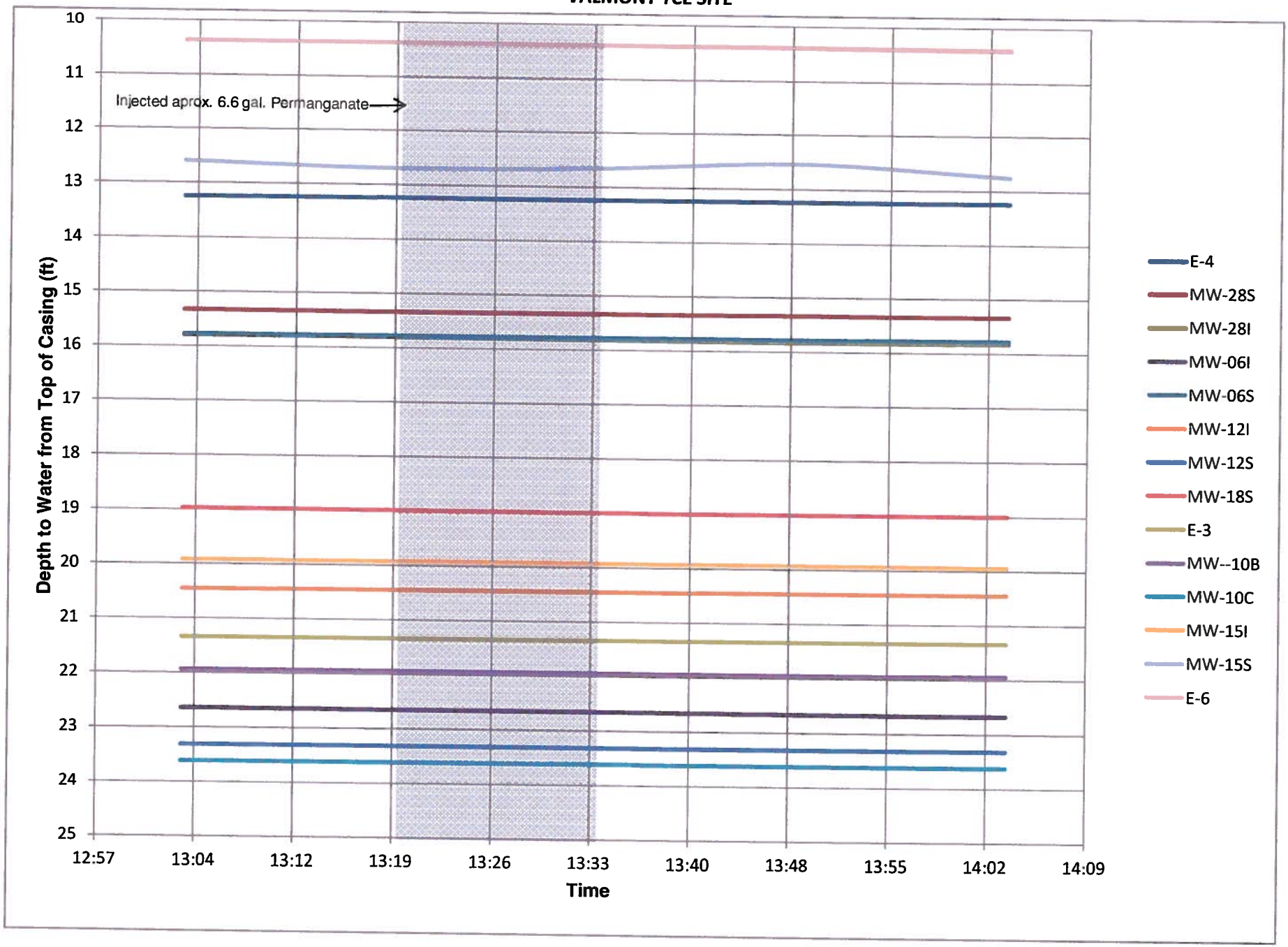
MW-11S INJECTION (44 FT- 54 FT ZONE)
MAY 22, 2013
VALMONT TCE SITE



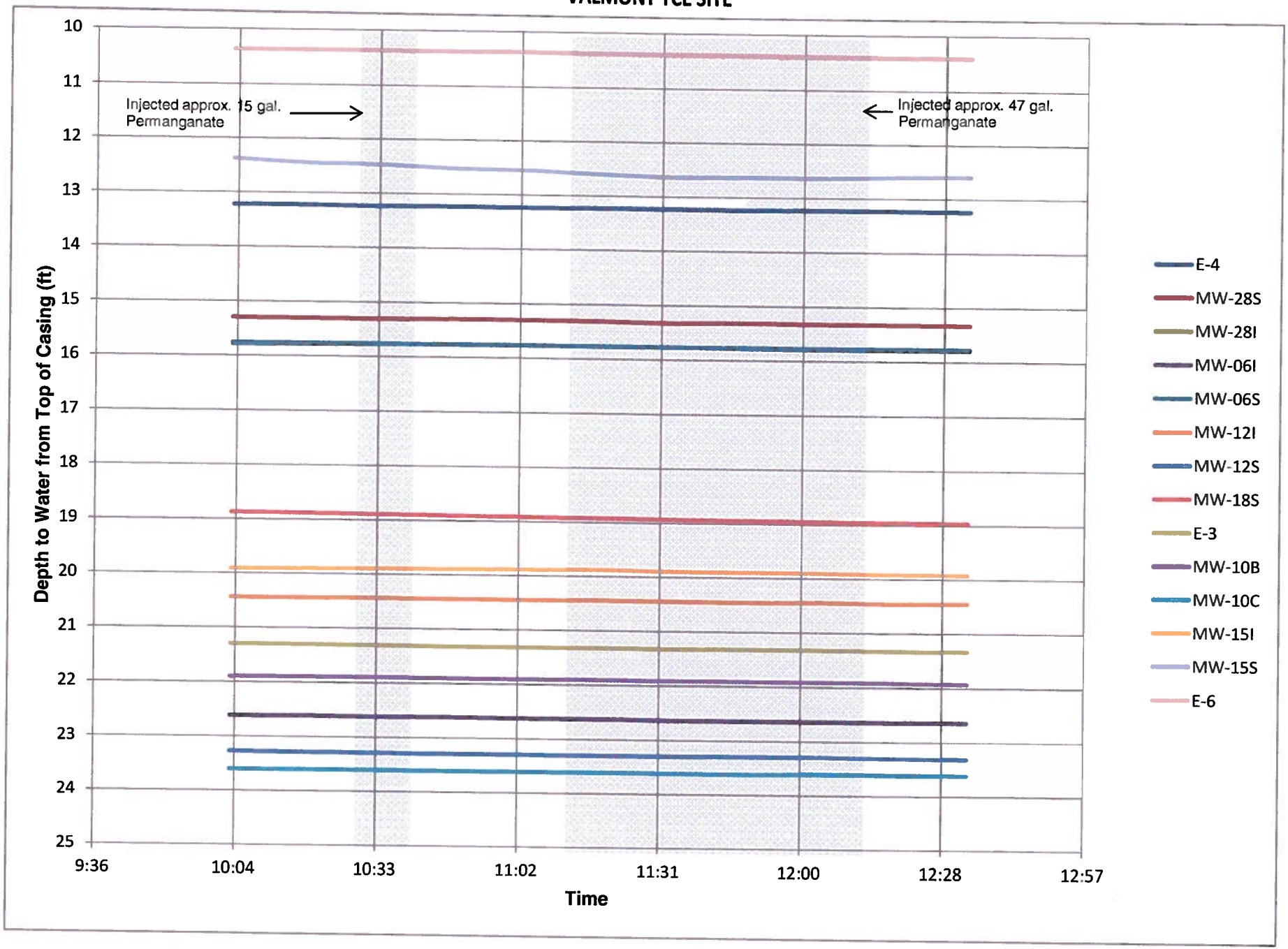
E-2 INJECTION (32 FT- 52 FT ZONE)
MAY 22, 2013
VALMONT TCE SITE



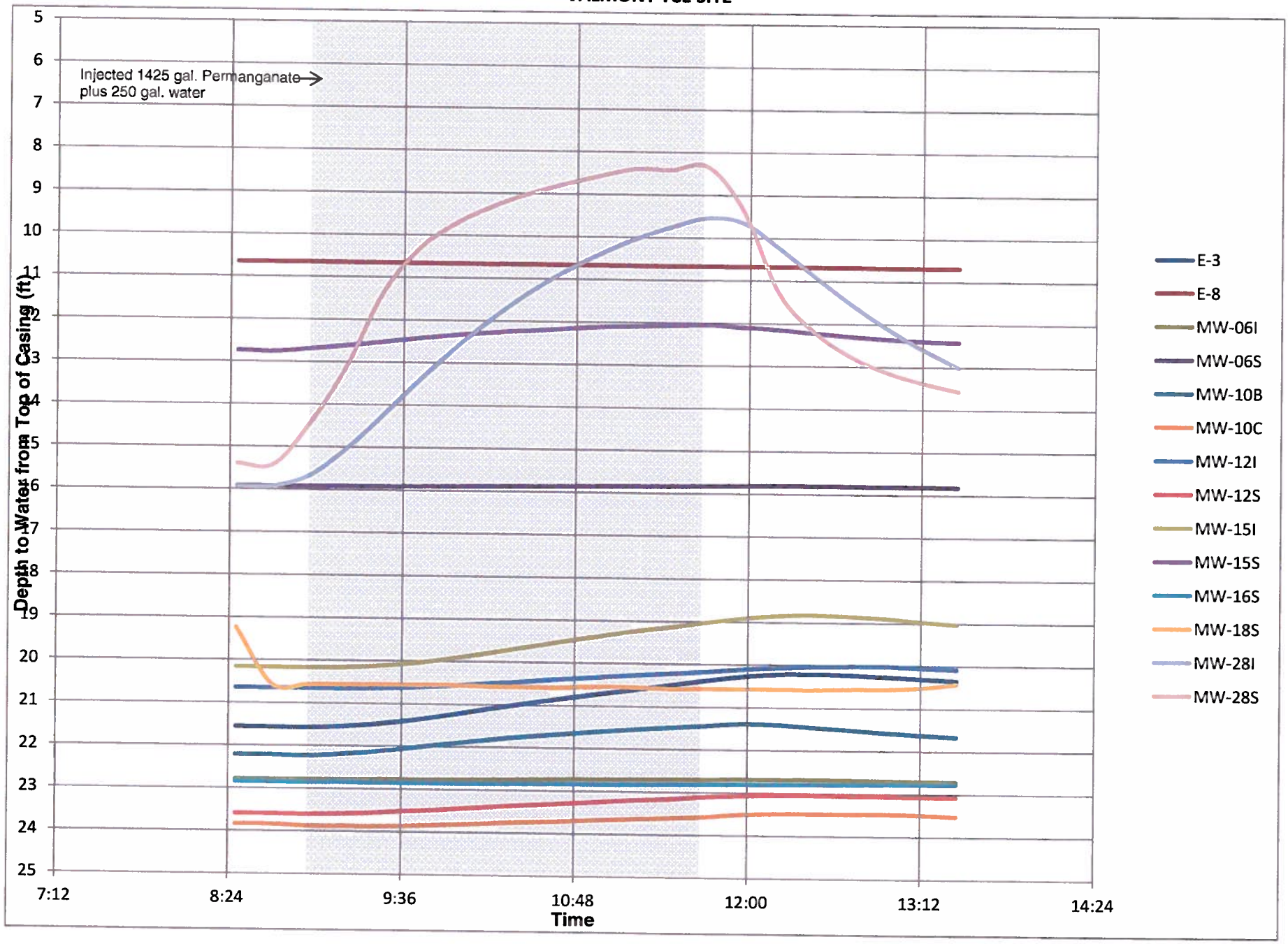
E-2 INJECTION (70 FT- 90 FT ZONE)
MAY 22, 2013
VALMONT TCE SITE



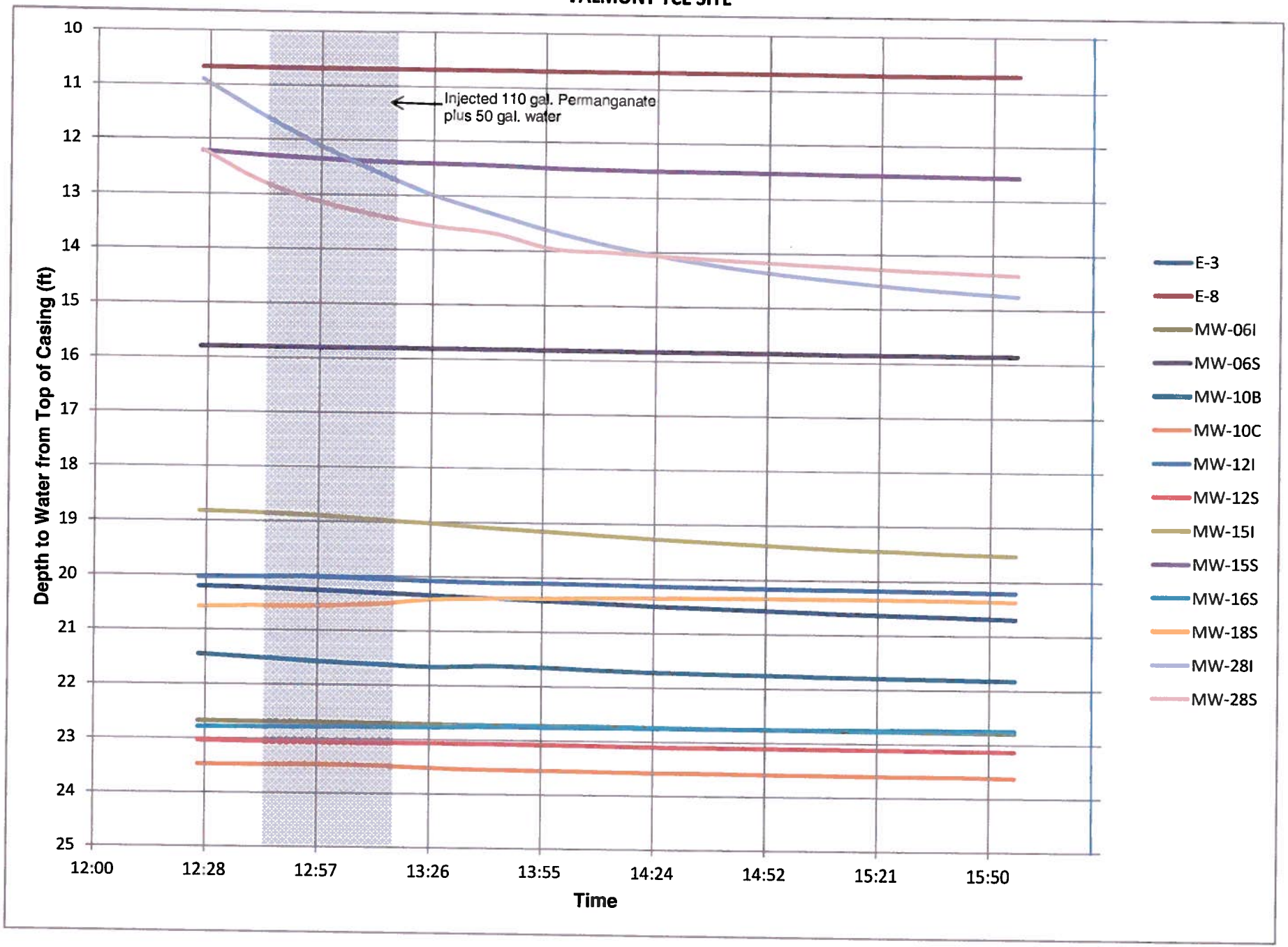
E-2 INJECTION (90 FT-110 FT ZONE)
MAY 22, 2013
VALMONT TCE SITE



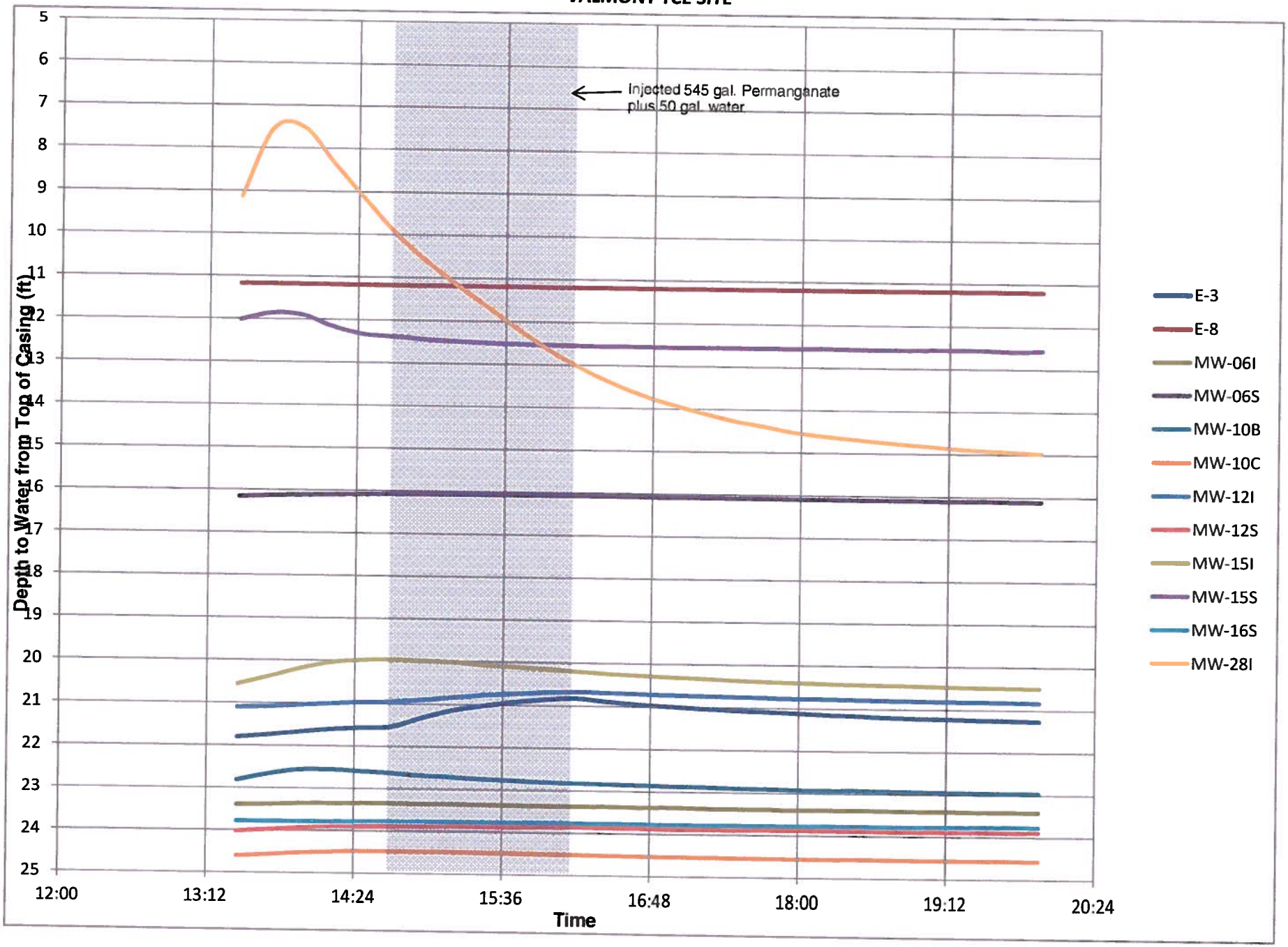
E-4 INJECTION (30 FT-50 FT ZONE)
MAY 23, 2013
VALMONT TCE SITE



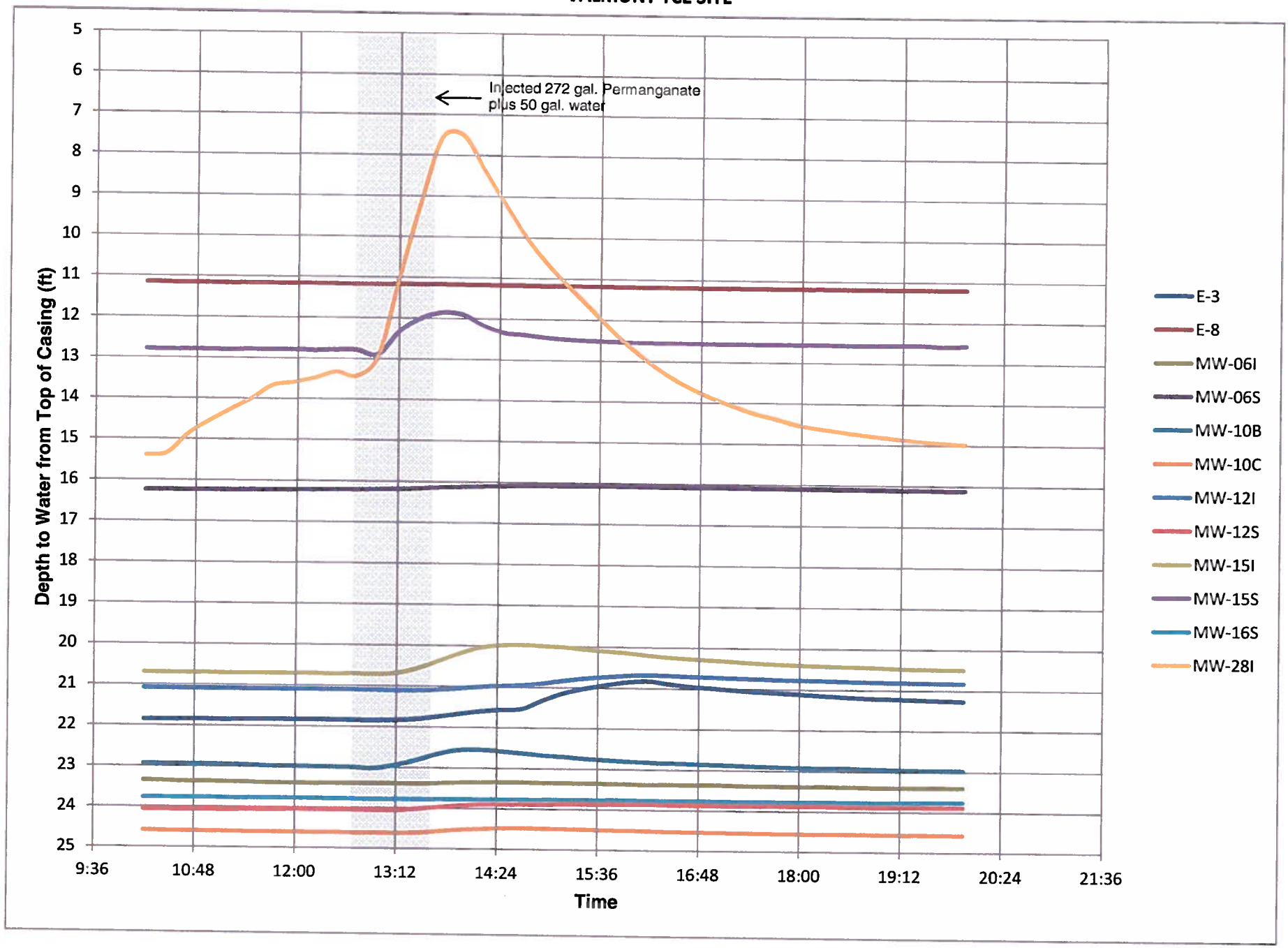
MW-22D INJECTION (294 FT-304 FT ZONE)
MAY 23, 2013
VALMONT TCE SITE



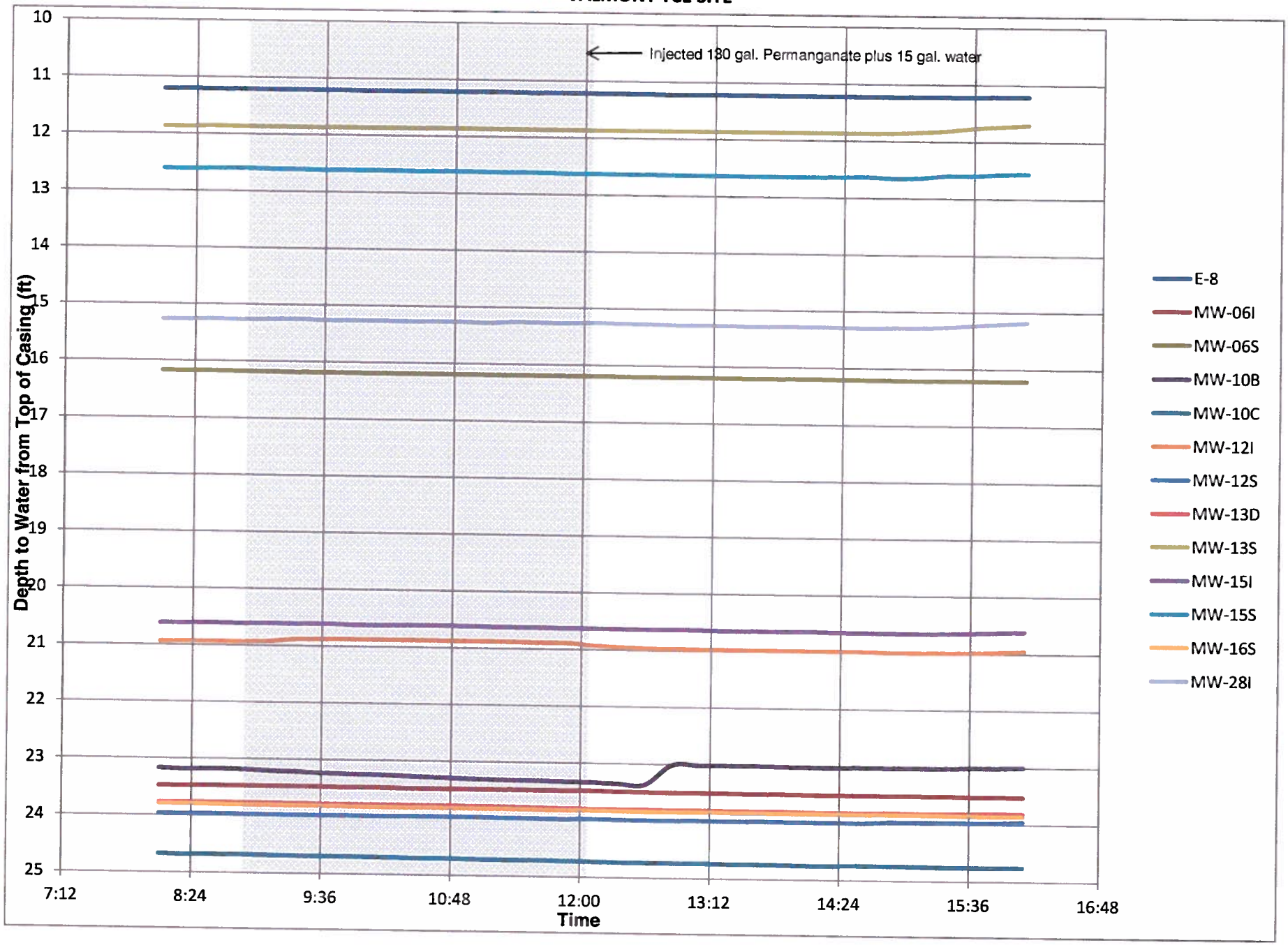
MW-18S INJECTION (16 FT-36 FT ZONE)
MAY 28, 2013
VALMONT TCE SITE



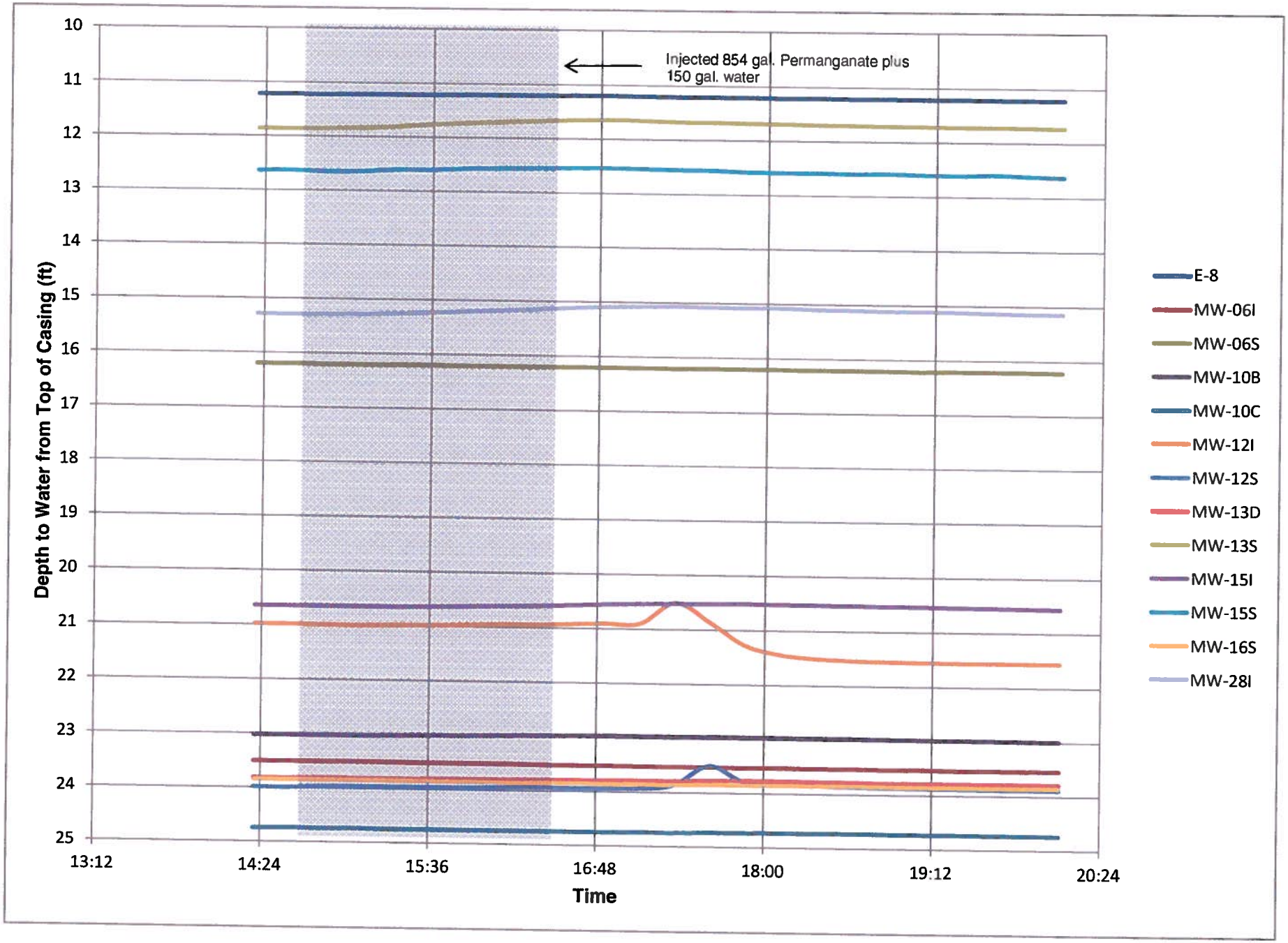
MW-28S INJECTION (35 FT- 45 FT ZONE)
MAY 28, 2013
VALMONT TCE SITE



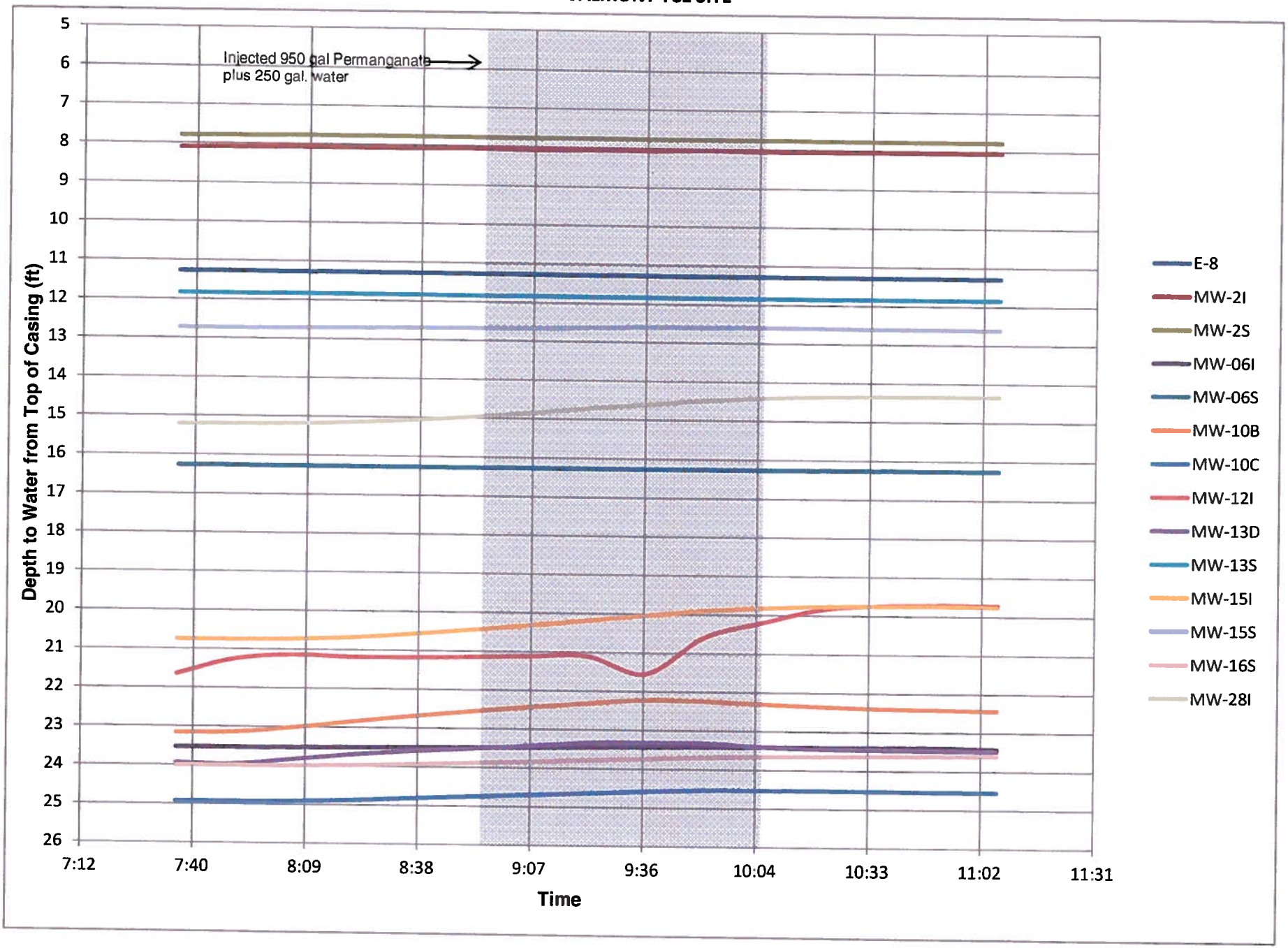
E-6 INJECTION (95 FT- 115 FT ZONE)
MAY 29, 2013
VALMONT TCE SITE



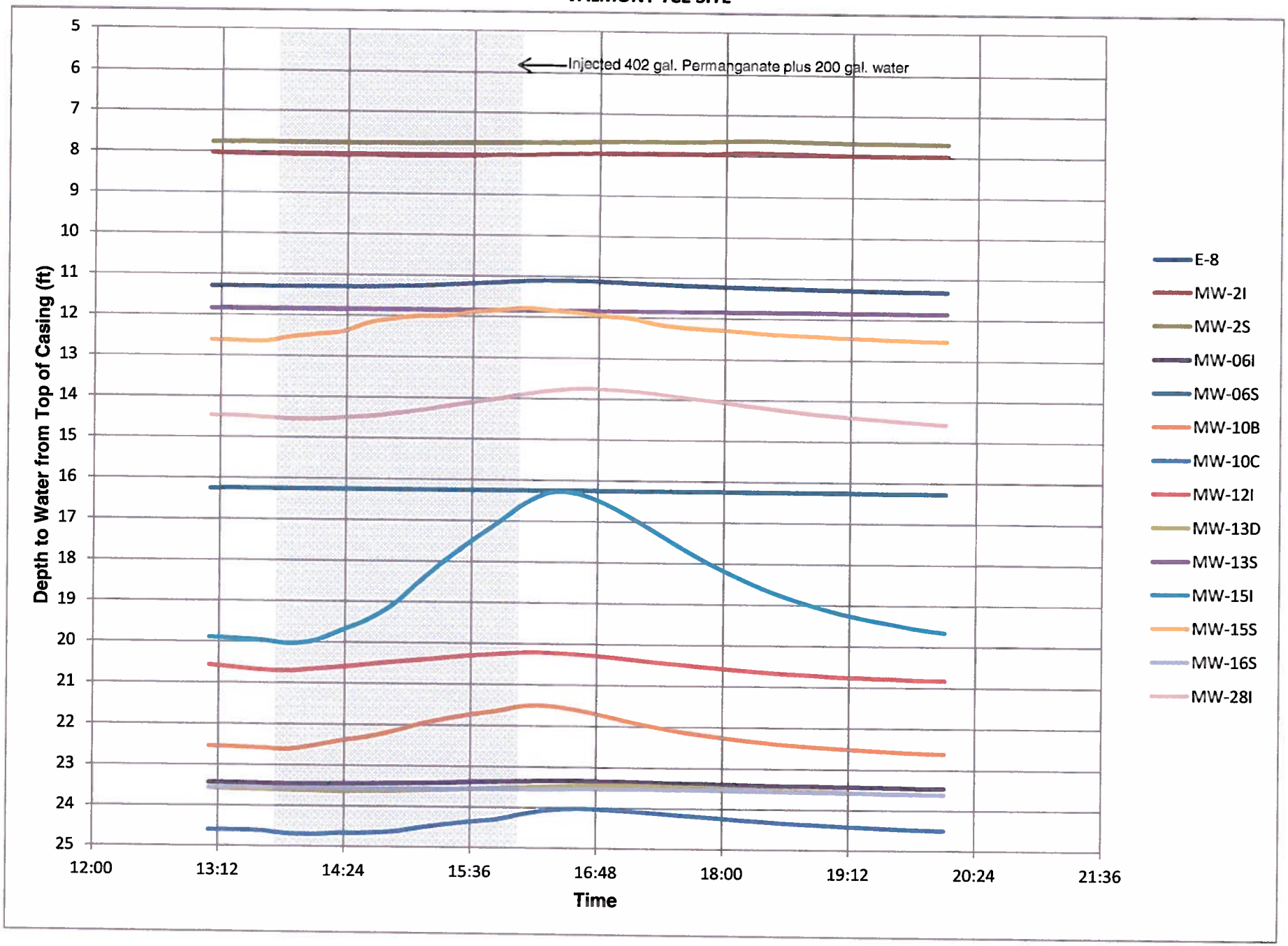
E-9 INJECTION (30 FT- 40 FT ZONE)
MAY 29, 2013
VALMONT TCE SITE



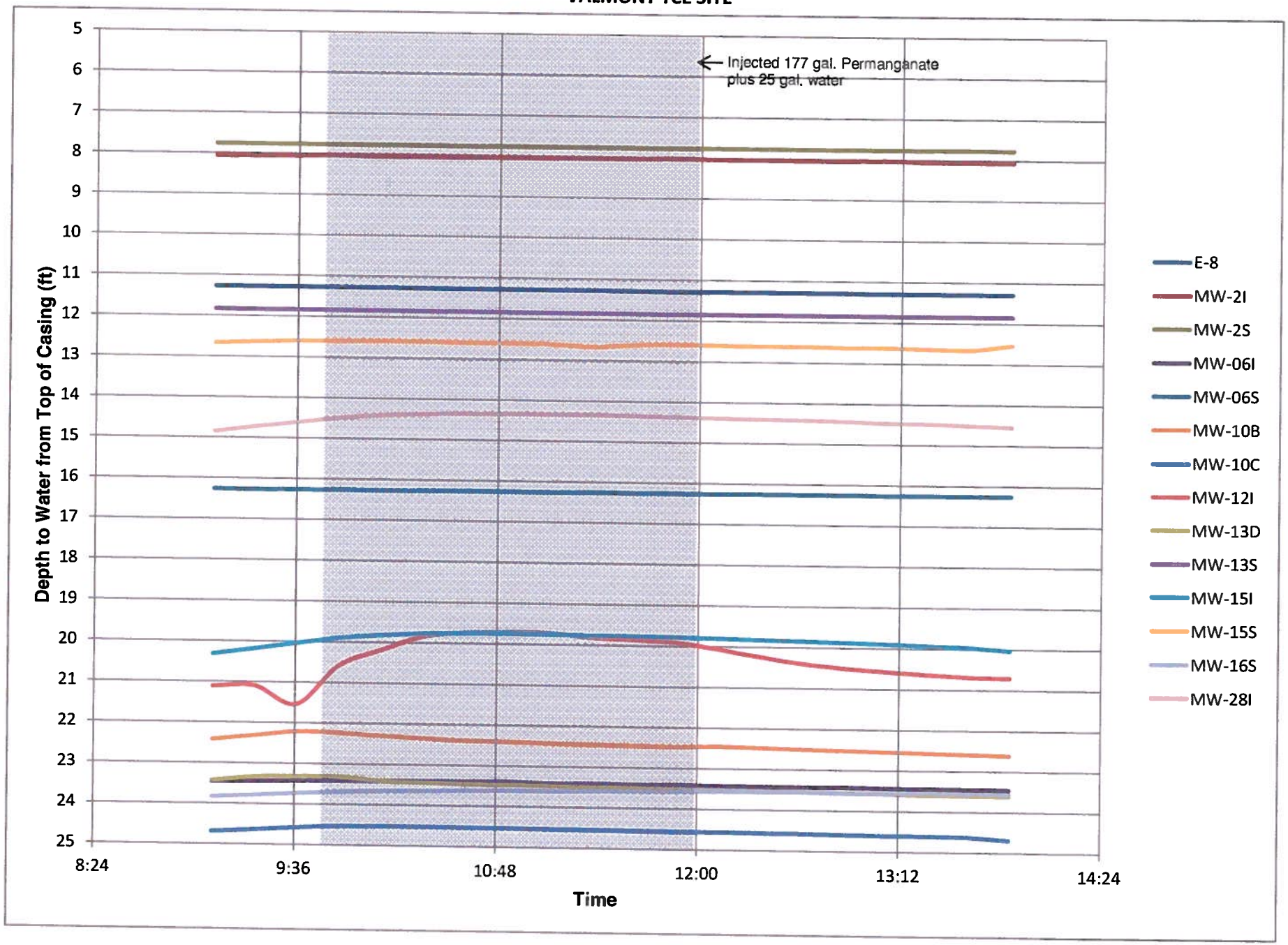
E-3 INJECTION (40 FT- 60 FT ZONE)
MAY 30, 2013
VALMONT TCE SITE



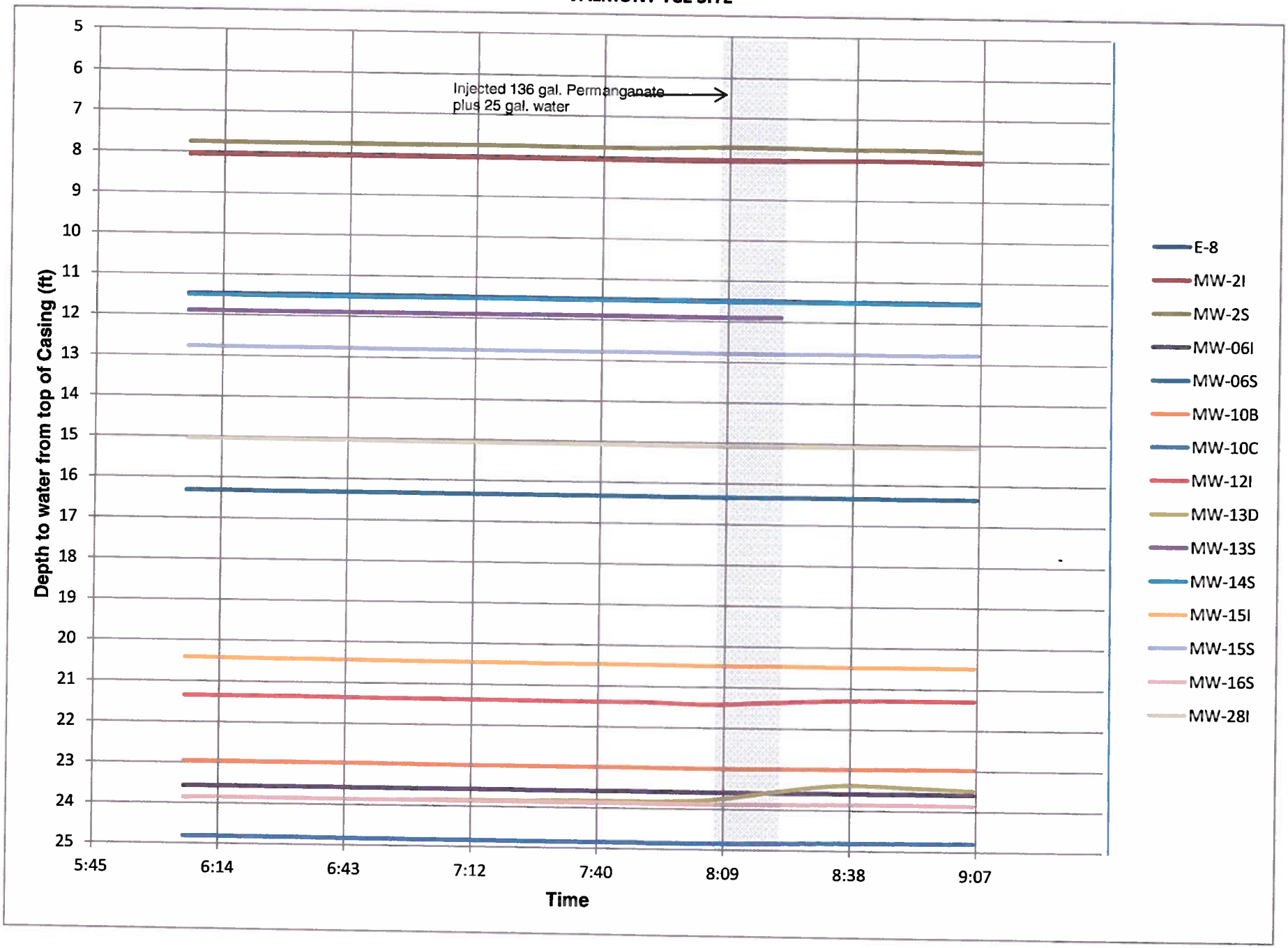
E-2 INJECTION (90 FT- 150 FT ZONE)
MAY 30, 2013
VALMONT TCE SITE



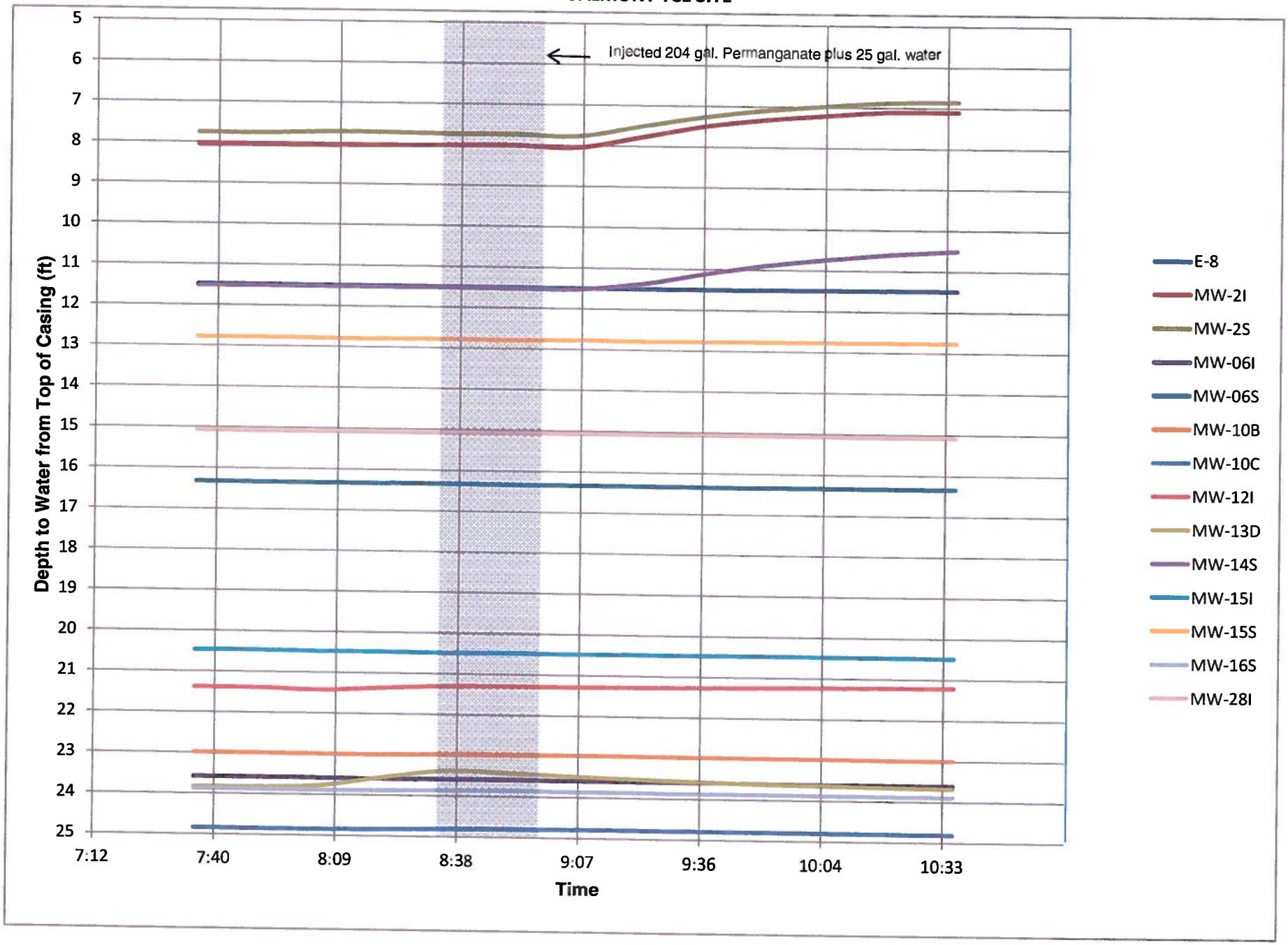
MW-12S INJECTION (45 FT- 58 FT ZONE)
MAY 30, 2013
VALMONT TCE SITE



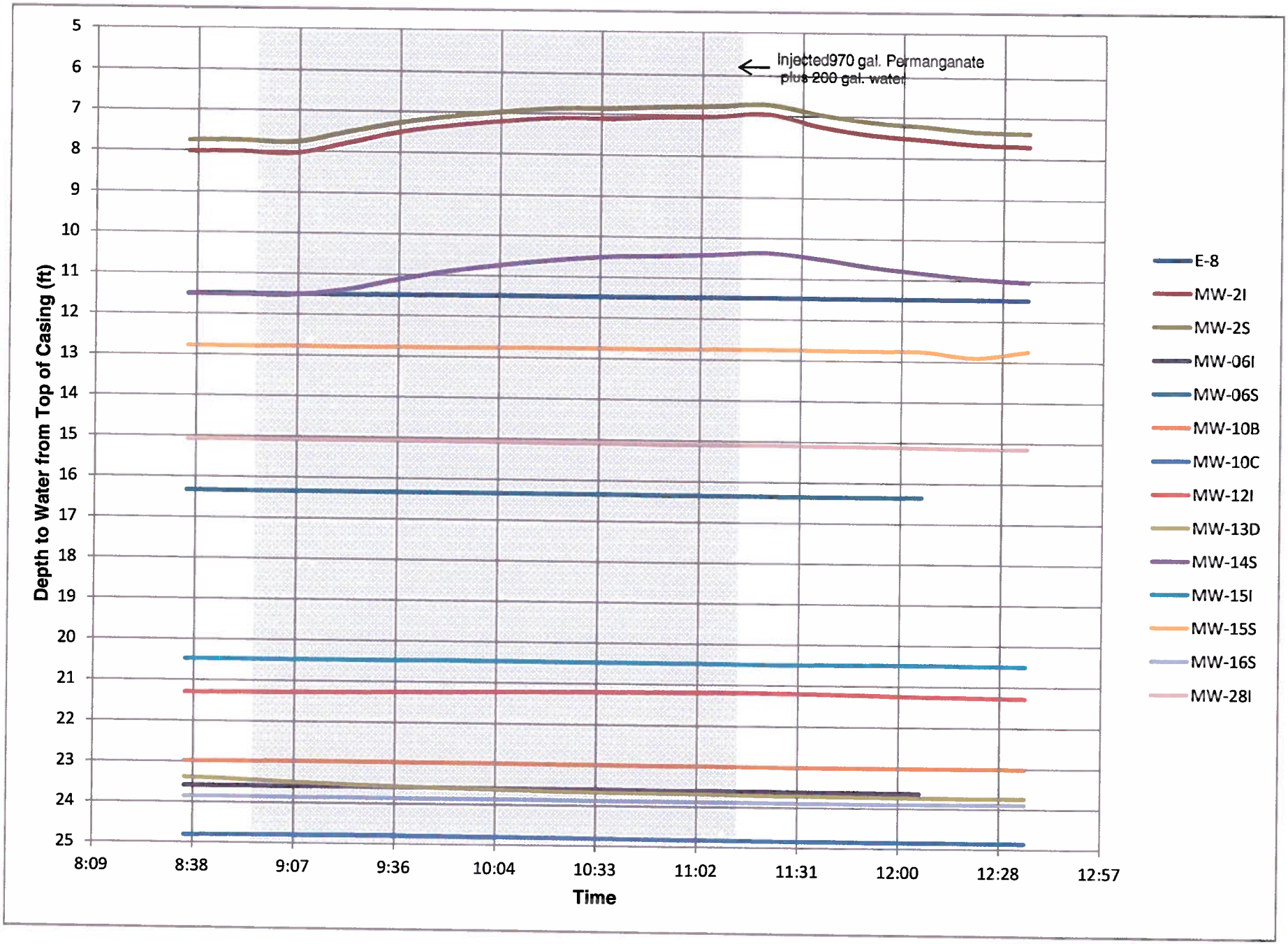
MW-13I INJECTION (78 FT- 88 FT ZONE)
MAY 31, 2013
VALMONT TCE SITE



MW-13S INJECTION (20 FT- 35 FT ZONE)
MAY 31, 2013
VALMONT TCE SITE



E-5 INJECTION (43 FT- 63 FT ZONE)
MAY 31, 2013
VALMONT TCE SITE



APPENDIX B

PROCESS MONITORING DATA

PIM PARAMETER DATA SHEET

PROJECT SITE NAME: Valmont TCE Site
PROJECT NUMBER: 112G04635
INJECTION TYPE: In-Situ Chemical Oxidation (Permanganate)

ROUND: 1 (Phase 2 ISCO Inj.)
DATE: 6/27/13 - 6/28/13

Well ID	Time (Hrs.)	Visual	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Colorimeter (mg/L)	Chloride (mg/L)	Visual Filtered	Water Level (Feet TOC)
E-1 Δ	07:55	Dark Purple	NOT TESTED - DARK PURPLE						>100	—	D.Purple	16.38
E-2 Δ	08:55	Dark Pink	5.68	0.156	52.3	3.27	16.84	609	46.5	45	Pink	6.48
E-3 Δ	15:05	Dark Purple	NOT TESTED - DARK PURPLE						>100	—	D.Purple	23.00
E-4 Δ	09:40	Dark Purple	NOT TESTED - DARK PURPLE						>100	—	D.Purple	12.80
E-5 Δ	16:15	Dark Purple	NOT TESTED - DARK PURPLE						>100	—	D.Purple	11.68
E-6 Δ	16:45	Dark Purple	NOT TESTED - DARK PURPLE						>100	—	D.Purple	11.54
E-7 Δ	08:25	Dark Purple	NOT TESTED - DARK PURPLE						>100	—	D.Purple	[redacted] (CE) 11.73
E-9 Δ	17:10	Dark Purple	NOT TESTED - DARK PURPLE						>100	—	D.Purple	12.33
MW-2S	11:15	Slight Red/Turbid	4.95	0.043	24.8	1.80	18.06	167	0.2	20	Clear	7.98
MW-2I	11:25	Clear	5.42	0.091	16.4	2.44	16.90	147	0.4	35	Clear	8.30
MW-6S	10:25	Clear	4.54	0.410	8.5	5.88	19.03	191	0.4	115	Clear	15.51
MW-6I	10:30	Clear	4.80	0.095	10.6	2.84	17.71	208	0.6	40	Clear	23.81
MW-10A Δ	08:10	Dark Purple	NOT TESTED - DARK PURPLE						>100	—	D.Purple	16.16
MW-10B	13:05	Clear	6.65	0.107	4.3	6.23	18.43	213	0.1	15	Clear	23.53
MW-10C	13:10	Dark Pink	6.32	0.148	114	5.47	17.76	544	18.5	35	Pink	25.41
MW-11S Δ	09:15	Dark Pink	6.02	1.13	385	3.28	16.27	647	>100	50	Purple	7.58
MW-11D Δ	09:30	Dark Purple	NOT TESTED - DARK PURPLE/ SEDIMENT						>100	—	D.Purple	9.55
MW-12S Δ	14:20	Dark Purple	NOT TESTED - DARK PURPLE						>100	—	D.Purple	24.62
MW-12I	14:10	Slightly turbid	6.43	0.243	62.9	3.66	21.27	144	0.8	55	Clear	21.90
MW-13S Δ	15:40	Dark Brown-MnO_2	6.28	0.216	71,000	3.38	18.39	602	44.9	70	D. Pink	11.98
MW-13I Δ	16:00	Clear	5.17	0.067	20.9	1.16	17.85	510	0.6	40	Clear	20.68

Δ Injection Well

SIGNATURE(S): [signature]

PIM PARAMETER DATA SHEET

PROJECT SITE NAME: Valmont TCE Site
PROJECT NUMBER: 112G04635
INJECTION TYPE: In-Situ Chemical Oxidation (Permanganate)

ROUND: 1 (Phase 2 ISCO INJ.)
DATE: 6/27/13 - 6/28/13

Well ID	Time (Hrs.)	Visual	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Colorimeter (mg/L)	Chloride (mg/L)	Visual Filtered	Water Level (Feet TOC)
MW-15S	12:20	Clear	5.48	0.025	0.0	3.33	18.89	148	0.6	15	Clear	12.46
MW-15D	12:30	Light Pink	5.47	0.153	54.5	3.71	17.99	500	2.8	15	L. Pink	21.13
MW-18S Δ	17:00	Dark Purple	NOT TESTED - DARK PURPLE						>100	—	D. Purple	19.85
MW-22D Δ	15:20	Purple	6.44	0.126	18.4	11.13 ↓	20.41	525	63.2	60	L. Purple	70.31
MW-28S Δ	13:30	Dark Purple/Brown	DARK PURPLE - NOT TESTED						>100	—	D. Purple	14.50
MW-28I	12:50	Clear	6.44	0.136	6.0	2.73	18.65	249	0.1	20	Clear	15.56
GW-9	10:55	Red-Brown/turbid	4.91	0.168	93.0	1.22	17.01	137	0.3	60	Clear	16.93

SIGNATURE(S): Geoff L. Ferri

PIM PARAMETER DATA SHEET

PROJECT SITE NAME: Valmont TCE Site
PROJECT NUMBER: 112G04635
INJECTION TYPE: In-Situ Chemical Oxidation (Permanganate)

ROUND: 2 (Round 2 ISCO Injection)
DATE: 8/5/2013

Well ID	Time (Hrs.)	Visual	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Colorimeter (mg/L)	Chloride (mg/L)	Visual Filtered	Water Level (Feet TOC)
E-1 Δ	11:40	Dark purple	Not		Tested				>100	—	Dark purple	19.09
E-2 Δ	12:25	Brown	6.70	0.114	61.6	3.16	17.65	548	2.1	30	Light Brown	9.30
E-3 Δ	12:54	Dark purple	Not		Tested				>100	—	Dark purple	23.20
E-4 Δ	12:34	Dark purple	Not		Tested				>100	—	Dark purple	13.43
E-5 Δ	13:12	Reddish Pink	6.28	0.128	122	3.31	16.78	671	32.1	25	Pink	12.21
E-6 Δ	13:45	Dark purple	Not		Tested				>100	—	Dark purple	12.38
E-7 Δ	12:05	Dark purple	Not		Tested				>100	—	Dark purple	14.98
E-9 Δ	13:35	purple	6.15	1.82	68.6	9.20	18.34	699	>100	30	purple	12.38
MW-2S	10:18	Clear	4.79	0.047	9.7	2.37	17.50	223	0	15	Clear	8.46
MW-2I	10:25	Pink	5.23	0.130	69.5	5.42	16.65	637	8.3	25	Pink	8.87
MW-6S	9:55	Clear	4.30	0.372	10.1	10.07	15.32	282	0.3	130	Clear	16.23
MW-6I	10:00	Cloudy	5.09	0.109	457	1.91	14.72	123	0	35	Clear	25.11
MW-10A Δ	11:50	Brown	7.22	0.614	122	8.58	18.52	462	18.8	50	Brown	17.96
MW-10B	11:25	Clear	5.87	0.137	26.8	2.13	15.43	361	0.3	20	Clear	24.85
MW-10C	11:30	Pink	6.85	1.40	67.2	3.79	15.62	375	9.2	15	Light Pink	26.79
MW-11S Δ	12:14	Reddish purple	6.78	0.297	77.3	2.80	19.24	617	60	40	Dark pink	9.80
MW-11D Δ	12:42	Dark purple	Not		Tested				>100	—	Dark purple	12.91
MW-12S Δ	12:20	Dark purple	Not		Tested				>100	—	Dark purple	27.72
MW-12I	12:46	Clear	6.51	0.324	32.9	1.86	17.14	417	0	75	Clear	23.05
MW-13S Δ	10:36	Clear	5.34	0.087	50.7	10.10	15.52	569	0	20	Clear	12.21
MW-13I Δ	10:45	Clear	4.89	0.064	34.1	9.50	16.10	650	0	20	Clear	21.75

Δ Injection Well

SIGNATURE(S): [signature]

PIM PARAMETER DATA SHEET

PROJECT SITE NAME: Valmont TCE Site
PROJECT NUMBER: 112G04635
INJECTION TYPE: In-Situ Chemical Oxidation (Permanganate)

ROUND: 2 (Round 2 ISCO Injection)
DATE: 8/15/2013

Well ID	Time (Hrs.)	Visual	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Colorimeter (mg/L)	Chloride (mg/L)	Visual Filtered	Water Level (Feet TOC)
MW-15S	10:55	Clear	4.96	0.041	15.7	3.41	15.14	474	0.1	10	Clear	12.78
MW-15D	11:05	Light Brown Tint	5.67	0.156	65.7	3.15	13.78	466	0.4	10	clear	22.36
MW-18S Δ	13:50	Dark purple		Not		Tested			>100	—	Dark purple	20.29
MW-22D Δ	13:05	Purple	7.13	0.149	26.8	6.95	16.43	555	60.7	45	purple	71.28
MW-28S Δ	11:12	Light Brown Tint	5.67	0.191	50.5	6.07	15.21	408	0.2	60	Clear	15.26
MW-28I	11:18	Clear	5.86	0.169	50.4	2.91	15.32	397	0	25	clear	16.38
GW-9	9:40	Clear	4.45	0.223	28.3	2.01	15.44	180	0	55	clear	17.81

SIGNATURE(S): Chen

Notes:

E-1: The ground water from water table to approximately 100 ft below ground surface (bgs) was clear.

E-2: The ground water from water table to approximately 140 ft bgs was clear to brown.

E-3: The ground water from water table to approximately 120 ft bgs was clear.

E-4: The ground water from water table to approximately 125 ft bgs was clear.

E-6: The ground water from water table to approximately 100 ft bgs was clear.

MW-13I: The bottom of well about 6 inches was purple.

*Note: E-2 turned purple during sampling on 9/11/13.

PIM PARAMETER DATA SHEET

PROJECT SITE NAME: Valmont TCE Site
PROJECT NUMBER: 112G04635
INJECTION TYPE: In-Situ Chemical Oxidation (Permanganate)

ROUND: 3 (Round 2 ISCO Injection)
DATE: 9/9/2013

Well ID	Time (Hrs.)	Visual	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Colorimeter (mg/L)	Chloride (mg/L)	Visual Filtered	Water Level (Feet TOC)
E-1 Δ	16:30	Dark Purple (>100)	Sample Not Analyzed									21.69
E-2 Δ	15:35	Medium Brown	7.59	0.029	30.8	9.23	12.89	435	0.8	40	Clear	11.49 *
E-3 Δ	17:00	Dark Purple (>100)	Sample Not Analyzed									26.65
E-4 Δ	16:50	Dark Purple (>100)	Sample Not Analyzed									15.78
E-5 Δ	13:30	Dark pink-brown	6.37	0.061	>1000	6.88	13.06	636	63.8	60	Purple	14.47
E-6 Δ	17:50	Dark Purple (>100)	Sample Not Analyzed									13.16
E-7 Δ	16:40	Dark Purple (>100)	Sample Not Analyzed									17.72
E-8	15:50	Slight tint	6.81	0.014	60.3	6.06	11.30	501	0.8	40	Clear	15.04
E-9 Δ	17:40	Purple-Brown	6.70	0.290	276	9.17	13.19	672	>100	Not Tested	Purple	14.57
MW-2S	13:05	Slight tint	5.53	0.021	29.6	7.78	13.81	199	0.5	40	Clear	10.41
MW-2I	13:15	Light brown-pink	5.95	0.027	56.4	8.29	13.29	230	0.7	60	Clear	10.38
MW-6S	11:30	Light brown/turbid	5.54	0.107	>1000	7.65	13.41	191	0.6	200	Clear	18.60
MW-6I	11:55	Slightly turbid	5.68	0.027	30.5	6.96	11.94	186	0.6	40	Clear	26.81
MW-10A Δ	14:20	Brown-purple	7.03	0.155	180	4.49	14.01	637	62.1	100	Red-Pink	20.53
MW-10B	14:30	Brown	7.51	0.038	608	5.19	14.02	458	1.0	40	Clear	26.84
MW-10C	16:15	Pink-Brown	7.63	0.045	223	6.18	12.53	470	8.3	40	L. Pink	28.75

Δ Injection Well

SIGNATURE(S): Cheryll A. Fiene

PIM PARAMETER DATA SHEET

PROJECT SITE NAME: Valmont TCE Site
PROJECT NUMBER: 112G04635
INJECTION TYPE: In-Situ Chemical Oxidation (Permanganate)

ROUND: 3 (Round 2 ISCO Injection)
DATE: 9/9/2013

Well ID	Time (Hrs.)	Visual	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Colorimeter (mg/L)	Chloride (mg/L)	Visual Filtered	Water Level (Feet TOC)
MW-11S Δ	15:55	L. Purple – Brown	6.22	0.062	107	6.35	13.24	698	> 100	Not Tested	Dark Purple	12.07
MW-11D Δ	16:00	Dark Purple (7/20)	Sample Not Analyzed									15.51
MW-12S Δ	17:15	Dark Purple (7/20)	Sample Not Analyzed									28.12
MW-12I	17:20	Medium Brown-Turb	7.77	0.063	306	4.42	12.43	513	1.1	100	Clear	25.32
MW-13S Δ	13:50	Light brown	7.18	0.019	41.8	5.36	14.47	526	1.0	40	Clear	14.31
MW-13I Δ	14:05	Dark Pink	6.23	0.017	66.8	10.45	13.83	695	32.6	40	Pink	23.82
MW-15S	14:45	Light brown-turbid	7.31	0.007	105	5.64	13.68	484	0.9	40	Clear	15.07
MW-15D	14:50	clear-L. brown	6.19	0.100	112	4.96	12.14	450	1.4	20	Clear	24.63
MW-18S Δ	15:00	Dark Purple (7/20)	Sample Not Analyzed									22.34
MW-22D Δ	17:10	Purple	8.04	0.034	23.8	8.99	13.69	566	64.5	Not Tested	Purple	72.03
MW-28S Δ	15:20	L brown – Purple	7.56	0.068	259	4.94	13.70	632	70.1	60	Dark Pink	18.05
MW-28I	15:05	Slight tint	7.24	0.047	30.3	10.82	13.06	370	0.6	40	Clear	18.86
GW-9	12:20	reddish tint-turbid	5.33	0.037	169	8.55	10.97	198	0.2	100	Clear	19.20
GW-21	12:05	Slight red tint	5.05	0.019	10.9	13.10	10.94	224	0.6	80	Clear	22.43

SIGNATURE(S): Cheryl L. Fucci

PIM PARAMETER DATA SHEET

PROJECT SITE NAME: Valmont TCE Site
PROJECT NUMBER: 112G04635
INJECTION TYPE: In-Situ Chemical Oxidation (Permanganate)

ROUND: 4 (Round 2 ISCO Injection)
DATE: 10/17/2013

Well ID	Time (Hrs.)	Visual	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Colorimeter (mg/L)	Chloride (mg/L)	Visual Filtered	Water Level (Feet TOC)
E-1 Δ	11:10	Dark purple		Not	Tested				>100	—	Dark purple	21.61
E-2 Δ	12:26	Brownish Pink	6.14	0.130	22.7	0.86	15.60	656	10.6	9	Brownish Pink	10.57
E-3 Δ	13:10	Dark Purple		Not	Tested				>100	—	Dark purple	26.76
E-4 Δ	12:55	Dark Purple		Not	Tested				>100	—	Dark Purple	15.60
E-5 Δ	10:00	Clear	5.51	0.189	31.2	2.16	14.78	169	0.3	7	Clear	14.95
E-6 Δ	13:52	Dark purple		Not	Tested				>100	—	Dark Purple	13.86
E-7 Δ	11:20	Purple	6.80	0.348	23.8	1.76	17.45	676	>100	—	Purple	8.20
E-9 Δ				Not	Sampled							
MW-2S	9:47	Cloudy	4.96	0.054	111	0.25	15.45	174	0.0	3	Clear	11.12
MW-2I	9:53	Cloudy	5.12	0.120	430	0.90	15.76	175	0.8	10	Clear	11.39
MW-6S	9:25	Clear	4.52	0.408	18.5	1.55	15.05	285	0.7	90	Clear	18.16
MW-6I	9:35	Cloudy	5.09	0.133	88.2	8.74	14.92	49	0.6	10	Clear	26.48
MW-10A Δ	10:44	Light Brown	5.64	0.496	26.1	2.53	16.02	493	2.4	60	Light Brown	20.27
MW-10B	10:50	Clear	5.67	0.156	12.7	0.66	14.92	457	1.0	6	Clear	26.59
MW-10C	10:57	Light Brown	6.77	1.02	29.0	1.85	15.28	116	1.0	7.5	Slight Brown	28.56
MW-11S Δ	12:37	Reddish Brown	6.14	0.123	99.1	1.42	15.46	677	7.6	6	Light pink	12.31
MW-11D Δ	12:45	Dark purple		Not	Tested				>100	—	Dark Purple	15.34
MW-12S Δ	13:28	Dark Purple		Not	Tested				>100	—	Dark purple	28.12
MW-12I	13:18	Light Brown Tint	5.76	0.279	87.8	1.07	18.48	559	0.6	45	Slight Brown	25.49
MW-13S Δ	10:15	Clear	5.50	0.091	26.2	1.79	15.23	204	0.7	5	Clear	14.93
MW-13I Δ	10:23	Reddish Brown	5.34	0.187	998	1.12	16.07	711	70	6	Light purple	24.23

Δ Injection Well

SIGNATURE(S): Chen

PIM PARAMETER DATA SHEET

PROJECT SITE NAME: Valmont TCE Site
PROJECT NUMBER: 112G04635
INJECTION TYPE: In-Situ Chemical Oxidation (Permanganate)

ROUND: 4 (Round 2 ISCO Injection)
DATE: 10/17/2013

Well ID	Time (Hrs.)	Visual	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Colorimeter (mg/L)	Chloride (mg/L)	Visual Filtered	Water Level (Feet TOC)
MW-15S	11:35	Clear	6.29	0.039	15.1	1.32	16.34	658	0.9	3.6	Clear	14.22
MW-15D	11:44	Clear	5.75	0.285	11.8	8.00	15.32	438	0.9	7.5	Clear	24.45
MW-18S Δ	14:05	Reddish purple	5.92	0.485	81.8	2.86	17.57	720	>100	>200	purple	21.82
MW-22D Δ	13:35	Purple	6.21	0.148	9.3	6.52	17.06	612	67.4	200	purple	72.02
MW-28S Δ	11:55	Light Red	6.06	0.220	23.3	0.85	17.83	686	31.8	140	Pink	18.12
MW-28I	12:10	Light Turbid	5.75	0.245	46.6	1.40	17.42	467	0.8	6.5	Clear	18.94
GW-9	9:04	Clear	4.67	0.227	26.5	4.17	15.51	143	1.0	30	Clear	18.65

SIGNATURE(S): [signature] chen

Notes:

E-1: The groundwater from water table to approximately 100 ft below ground surface (bgs) was clear.

E-2: The groundwater from water table to approximately 140 ft bgs was clear to brown.

E-3: The groundwater from water table to approximately 135 ft bgs was clear.

E-4: The groundwater from water table to approximately 130 ft bgs was clear.

E-6: The groundwater from watertable to approximately 100 ft bgs was clear.

MW-11S: The bottom of well about 1 foot was purple.

MW-28S: The bottom of well about 1 foot was purple.

PIM PARAMETER DATA SHEET

PROJECT SITE NAME: Valmont TCE Site
PROJECT NUMBER: 112G04635
INJECTION TYPE: In-Situ Chemical Oxidation (Permanganate)

ROUND: 5 (Round 2 ISCO Injection)
DATE: 11/14/2013

Well ID	Time (Hrs.)	Visual	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Colorimeter (mg/L)	Chloride (mg/L)	Visual Filtered	Water Level (Feet TOC)
E-1 Δ	14:00	Dark purple		Not	Tested				>100	—	Dark purple	22.02
E-2 Δ	12:38	clear	6.95	0.082	14.9	2.06	11.20	430	1.0	15	clear	10.79
E-3 Δ	13:35	Dark purple		Not	Tested				>100	—	Dark purple	27.30
E-4 Δ	13:43	Pink	6.79	0.301	8.2	1.24	11.86	627	6.0	50	pink	16.75
E-5 Δ	10:51	Clear	6.25	0.143	22.8	1.05	12.74	79	0.0	15	Clear	15.81
E-6 Δ	14:40	Dark purple		Not	Tested				>100	—	Dark purple	15.06
E-7 Δ	13:55	Dark purple		Not	Tested				>100	—	Dark purple	17.34
E-9 Δ	14:12	Brown	6.49	0.871	338	1.07	12.49	492	1.2	60	Slight Brown	15.72
MW-2S	10:35	Clear	5.45	0.046	29.3	5.74	12.82	164	1.9	20	Clear	12.05
MW-2I	10:42	Clear	5.90	0.110	13.7	3.18	11.95	151	0.0	25	Clear	12.26
MW-6S	10:16	White Tint	4.67	0.355	134	9.51	12.39	248	0.9	140	Clear	18.46
MW-6I	10:21	White Tint	5.80	0.121	198	10.06	12.00	113	2.0	30	Clear	26.65
MW-10A Δ	11:45	Light Brown Tint	7.40	0.441	53.6	1.04	11.80	425	1.7	65	Clear	23.16
MW-10B	11:19	clear	6.11	0.123	9.6	1.30	12.27	114	0.5	15	clear	26.89
MW-10C	11:26	Clear	8.15	0.201	56.0	2.63	12.18	293	0.3	20	Clear	28.83
MW-11S Δ	12:47	Reddish Brown	6.64	0.072	56.9	2.35	10.56	602	4.5	15	slight pink	13.08
MW-11D Δ	12:55	Brownish purple		Not	Tested				>100	—	Dark purple	15.91
MW-12S Δ	13:20	Dark purple		Not	Tested				>100	—	Dark purple	28.63
MW-12I	13:12	Light Reddish Brown	6.51	0.309	64.1	1.16	11.45	611	2.0	90	slight pink	26.00
MW-13S Δ	11:02	Brown Tint	5.89	0.067	167	1.06	12.59	146	0.5	10	clear	15.82
MW-13I Δ	11:10	Clear	5.51	0.044	16.8	1.73	12.15	189	0.4	15	Clear	24.95

Δ Injection Well

SIGNATURE(S): Chen

PIM PARAMETER DATA SHEET

PROJECT SITE NAME: Valmont TCE Site
PROJECT NUMBER: 112G04635
INJECTION TYPE: In-Situ Chemical Oxidation (Permanganate)

ROUND: 5 (Round 2 ISCO Injection)
DATE: 11/14/2013

Well ID	Time (Hrs.)	Visual	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Colorimeter (mg/L)	Chloride (mg/L)	Visual Filtered	Water Level (Feet TOC)
MW-15S	12:00	Clear	6.57	0.033	7.8	1.47	11.69	402	0.0	15	Clear	14.49
MW-15D	12:08	Clear	6.46	0.244	12.4	1.46	11.27	169	0.0	10	Clear	24.91
MW-18S Δ	14:22	Reddish Brown	6.54	0.360	160	4.86	12.78	686	20.0	50	Pink	22.42
MW-22D Δ	13:25	Purple	6.31	0.137	34.7	7.09	11.04	616	61.2	60	purple	72.16
MW-28S Δ	12:17	Brownish Red	6.18	0.168	627	2.00	13.46	674	44.1	40	Dark Pink	18.24
MW-28I	12:30	Light Gray Tint	7.05	0.168	270	1.71	12.91	263	0.2	15	Clear	19.26
GW-9	10:00	Light Brown Turbid	4.70	0.229	120	10.15	12.02	208	0.0	50	clear	18.76

SIGNATURE(S): Tao Chen

Notes:

E-1: The groundwater from water table to approximately 110 ft below ground surface (bgs) was clear.

E-3: The groundwater from water table to approximately 120 ft bgs was clear.

E-4: The groundwater from water table to approximately 135 ft bgs was clear.

E-6: The groundwater from water table to approximately 110 ft bgs was clear.

E-7: The groundwater from water table to approximately 85 ft bgs was clear.

DATA SUMMARY OF VOLATILE ORGANIC COMPOUND RESULTS
SEPTEMBER 2013 GROUNDWATER SAMPLES
VALMONT TCE SITE, WEST HAZLETON, PENNSYLVANIA

Location:	E-8	GW-9	GW-21	MW-02S	MW-02S-D	MW-6S	MW-6I	MW-11D	MW-11S	MW-13S	RB-01	TB-01
Sample Date:	9/10/2013	9/10/2013	9/11/2013	9/10/2013	9/10/2013	9/10/2013	9/10/2013	9/11/2013	9/11/2013	9/10/2013	9/11/2013	9/10/2013
Duplicate of:					MW-02S							
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1,1-Trichloroethane	21	9.1	7.6	10	8.8	2 J	8.1	6	500	13	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloro-1,2,2-trifluoroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	9	5 U	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 R	5 R	5 U	5 U	5 U
1,1-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5.7	1.3 J	5 U	5 U
1,1-Dichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 U	5 U	5 U
1,2,3-Trichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromo-3-chloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethene (cis)	5 U	3.6 J	5 U	5 U	5 U	5 U	5 U	5 UJ	5 UJ	59	5 U	5 U
1,2-Dichloroethene (trans)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 U	5 U	5 U
1,2-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,4-Dioxane	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U
2-Butanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-pentanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	38	10 U	10 U	10 U
Benzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromodichloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2.2 J
Carbon Disulfide	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Tetrachloride	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 U	5 UJ	5 U
Chlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 R	5 R	5 U	5 U	5 U
Cyclohexane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Isopropylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
M,p-xylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl Acetate	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl Tert-butyl Ether	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylcyclohexane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylene Chloride	1.1 J	1.3 J	1.2 J	1.3 J	1.2 J	1.2 J	1.4 J	5 U	5 U	1.8 J	1.5 J	1.6 J
O-xylene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	2.4 J	1.5 J	4.7 J	3.5 J	4 J	3.7 J	1.4 J	2.5 J	2.7 J	4.1 J	3.7 J
trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 R	5 R	5 U	5 U	5 U
Trichloroethene	250	280	160	55	48	48	30	5 U	3.8 J	480	5 U	5 U
Trichlorofluoromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 U	5 U	5 U

PIM PARAMETER DATA SHEET

PROJECT SITE NAME: Valmont TCE Site
PROJECT NUMBER: 112G04635
INJECTION TYPE: In-Situ Chemical Oxidation (Permanganate)

ROUND: 6 (Round 2 ISCO Injection)
DATE: ~~10/15/2013~~ 12-23-13

Well ID	Time (Hrs.)	Visual (Unfiltered)	Visual (Filtered - 0.45µm)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP (mV)	Chloride (mg/L)	Colorimeter (mg/L)	Water Level (Ft. Below TOC)
E-1 Δ	1158	Dark	Purple	—	Not Tested			—	—	—	>100	15.75
E-2 Δ	1233	Clear	Clear	6.49	0.1138	7.76	1.49	11.21	209	20	0.4	5.45
E-3 Δ	1405	Dark	Purple	—	Not Tested			—	—	—	>100	20.87
E-4 Δ	1313	Light Brown Tint Clear	Clear	8.24	0.853	11.63	1.81	12.47	191	80	0.6	11.77
E-5 Δ	1343	Light Brn Tint Clear	Clear	6.50	0.1151	13.7	2.27	12.30	287	40	1.4	10.15
E-6 Δ	1410	Dark	Purple	—	Not Tested			—	—	—	>100	9.90
E-7 Δ	1203	Dark	Purple	—	Not Tested			—	—	—	>100	10.88
E-8	—	—	—	—	Not Tested			—	—	—	—	—
E-9 Δ	1413	Pink		—	Not Tested			—	—	—	>100	10.96
MW-2S	1329	Light Brown	Clear	6.62	0.1068	68.7	2.02	11.87	271	40	1.5	6.81
MW-2I	1334	Light Brown	Clear	6.50	0.1128	25.5	2.35	11.63	289	40	1.5	7.06
MW-6S	1123	Light Brown	Clear	4.70	0.284	39	2.83	12.58	405	120	0.7	12.00
MW-6I	1127	Light Brown	Clear	5.76	0.123	47	2.25	12.07	366	20	4.4	20.38
MW-10A Δ	1142	Tinted Brown	Clear	6.51	0.431	43.9	2.68	1269	343	80	0.9	14.34
MW-10B	1145	Clear	Clear	6.50	0.1156	8.83	1.02	12.34	308	20	0.0	20.66
MW-10C	1148	Tan Tint	Clear	6.55	0.203	18.6	1.00	12.29	298	40	0.0	22.84
MW-11S Δ	1249	Light Brown	Clear	6.61	0.093	11.2	1.97	11.05	233	20	0.0	7.41
MW-11D Δ	1243	Dark	Purple	—	Not Tested			—	—	—	>100	10.08
MW-12S Δ	1400	Dark	Purple	—	Not Tested			—	—	—	>100	22.92
MW-12I	1403	Red Brown	Pink	6.43	0.297	19.2	1.19	12.47	597	80	2.8	20.01
MW-13S Δ	1347	Light Brown	Clear	5.92	0.1088	29.5	1.73	12.44	315	20	1.4	10.07
MW-13I Δ	1352	Light Brn Tint	Clear	5.25	0.1058	11.9	0.83	12.18	464	20	1.2	19.90

Δ Injection Well

SIGNATURE(S):

E-1 Purple at 110 Feet to the bottom of the well
E-3 Purple at 120 Feet to the bottom of the well
E-6 Purple at 110 Feet to the bottom of the well
E-7 Purple at 85 Feet to the bottom of the well

PIM PARAMETER DATA SHEET

PROJECT SITE NAME: Valmont TCE Site
PROJECT NUMBER: 112G04635
INJECTION TYPE: In-Situ Chemical Oxidation (Permanganate)

ROUND: 6 (Round 2 ISCO Injection)
DATE: 12/23/2013

Well ID	Time (Hrs.)	Visual	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Colorimeter (mg/L)	Chloride (mg/L)	Visual Filtered	Water Level (Feet TOC)
MW-15S	1224	Clear	5.80	0.043	6.56	1.58	11.91	341	0.7	20	Clear	8.43
MW-15D	1226	Clear	6.20	0.324	7.20	1.49	11.66	262	0.0	40	Clear	18.72
MW-18S Δ	1415	Red Brown	6.37	0.331	113	3.97	12.43	475	4.3	40	Pink	17.30
MW-22D Δ	1420	Purple	—	—	—	Not Tested		—	>100	—	Purple	69.40
MW-28S Δ	1313	Light Brown Tint Clear	6.24	0.188	11.71	1.20	13.01	275	0.4	60	Clear	12.75
MW-28I	1315	Light Brown Tint Clear	8.99	0.626	11.92	2.48	12.72	96	2.1	200	Clear	13.54
GW-9	1115	Light Tan	4.49	0.157	27.6	1.88	11.26	460	5.5	60	Clear	13.18

SIGNATURE(S):

SUMMARY OF PROCESS MONITORING FIELD RESULTS
ROUND 2 INJECTIONS
VALMONT TCE SITE, WEST HAZLETON, LUZERNE COUNTY, PENNSYLVANIA

Location:	E-2	E-2	E-2	E-2	E-2	E-2	E-4	E-4	E-5
Sample ID:	E-2-20130627	E-2-20130805	E-2-20130909	E-2-20131017	E-2-20131114	E-2-20131223	E-4-20131114	E-4-20131223	E-5-20130805
Sample Date:	6/27/2013	8/5/2013	9/9/2013	10/17/2013	11/14/2013	12/19/2013 12/23/2013	11/14/2013	12/20/2013 12/23/2013	8/5/2013
FIELD PARAMETERS									
Chloride (mg/L)	45	30	40	9	15	20	50	80	25
Colorimeter (mg/L)	46.5	2.1	0.8	10.6	1	0.14	6	0.6	32.1
Conductivity (mS/cm)	0.156	0.114	0.029	0.13	0.082	0.076	0.301	0.284	0.128
Dissolved Oxygen (mg/L)	3.27	3.16	9.23	0.86	2.06	2.44	1.24	1.82	3.31
Oxidation-reduction Potential (mV)	609	548	435	656	430	209	627	1.91	671
pH (S.U.)	5.68	6.7	7.59	6.14	6.95	5.13	6.79	6.09	6.28
Temperature (°C)	16.84	17.65	12.89	15.6	11.2	10.84	11.86	14.1	16.78
Turbidity (NTU)	52.3	61.6	30.8	22.7	14.9	33.5	8.2	98.6	122

SUMMARY OF PROCESS MONITORING FIELD RESULTS
ROUND 2 INJECTIONS
VALMONT TCE SITE, WEST HAZLETON, LUZERNE COUNTY, PENNSYLVANIA

Location:	E-5	E-5	E-5	E-5	E-7	E-7	E-8	E-8	E-9	E-9
Sample ID:	E-5-20130909	E-5-20131017	E-5-20131114	E-5-20131223	E-7-20131017	E-7-20131219	E-8-20130910	E-8-20131223	E-9-20130805	E-9-20130909
Sample Date:	9/9/2013	10/17/2013	11/14/2013	12/18/2013 12/23/2013	10/17/2013	12/19/2013	9/9/2013 9/10/2013	12/18/2013 12/23/2013	8/5/2013	9/9/2013
FIELD PARAMETERS										
Chloride (mg/L)	60	7	15	40	NA	NA	40	NA	30	NA
Colorimeter (mg/L)	63.8	0.3	0	1.4	100 >	NA	0.8	NA	100 >	100
Conductivity (mS/cm)	0.061	0.189	0.143	0.13	0.348	0.167	0.011	0.055	1.82	0.29
Dissolved Oxygen (mg/L)	6.88	2.16	1.05	1.58	1.76	1.04	5.65	3.06	9.2	9.17
Oxidation-reduction Potential (mV)	636	169	79	287	676	NA	384	287	699	672
pH (S.U.)	6.37	5.51	6.25	6.27	6.8	6.17	5.38	5.24	6.15	6.7
Temperature (°C)	13.06	14.78	12.74	13.4	17.45	12.93	10.19	10.01	18.34	13.19
Turbidity (NTU)	1000 >	31.2	22.8	12.7	23.8	70.8	13.3	16.5	68.6	276

SUMMARY OF PROCESS MONITORING FIELD RESULTS
ROUND 2 INJECTIONS
VALMONT TCE SITE, WEST HAZLETON, LUZERNE COUNTY, PENNSYLVANIA

Location:		E-9		E-9	GW-21	GW-21	GW-9	GW-9	GW-9	GW-9
Sample ID:		E-9-20131114		E-9-20131218	GW-21-20130911	GW-21-20131217	GW-9-20130627	GW-9-20130805	GW-9-20130910	GW-9-20131017
Sample Date:		11/14/2013		12/18/2013	9/9/2013 9/11/2013	12/17/2013	6/27/2013	8/5/2013	9/9/2013 9/10/2013	10/17/2013
FIELD PARAMETERS										
Chloride (mg/L)		60		NA	80	NA	60	55	100	30
Colorimeter (mg/L)	>	1.2	>	NA	0.6	NA	0.3	0	0.2	1
Conductivity (mS/cm)		0.871		1.05	0.093	0.093	0.168	0.223	0.034	0.227
Dissolved Oxygen (mg/L)		1.07		2.84	2.72	2.75	1.22	2.01	4.13	4.17
Oxidation-reduction Potential (mV)		492		NA	315	NA	137	180	332	143
pH (S.U.)		6.49		6.45	4.64	5.55	4.91	4.45	4.74	4.67
Temperature (°C)		12.49		11.54	15.04	9.79	17.01	15.44	10.39	15.51
Turbidity (NTU)		338		698	1.74	0	93	28.3	6.42	26.5

SUMMARY OF PROCESS MONITORING FIELD RESULTS
ROUND 2 INJECTIONS
VALMONT TCE SITE, WEST HAZLETON, LUZERNE COUNTY, PENNSYLVANIA

Location:	GW-9	GW-9	MW-02I	MW-02I	MW-02I	MW-02I	MW-02I
Sample ID:	GW-9-20131114	GW-9-20131223	MW-02I-20130627	MW-02I-20130805	MW-02I-20130909	MW-02I-20131017	MW-02I-20131114
Sample Date:	11/14/2013	12/17/2013 12/23/2013	6/27/2013	8/5/2013	9/9/2013	10/17/2013	11/14/2013
FIELD PARAMETERS							
Chloride (mg/L)	50	60	35	25	60	10	25
Colorimeter (mg/L)	0	5.5	0.4	8.3	0.7	0.8	0
Conductivity (mS/cm)	0.229	0.156	0.091	0.13	0.027	0.12	0.11
Dissolved Oxygen (mg/L)	10.15	2.51	2.44	5.42	8.29	0.9	3.18
Oxidation-reduction Potential (mV)	208	460	147	637	230	175	151
pH (S.U.)	4.7	5.05	5.42	5.23	5.95	5.12	5.9
Temperature (°C)	12.02	11.59	16.9	16.65	13.29	15.76	11.95
Turbidity (NTU)	120	3.92	16.4	69.5	56.4	430	13.7

SUMMARY OF PROCESS MONITORING FIELD RESULTS
ROUND 2 INJECTIONS
VALMONT TCE SITE, WEST HAZLETON, LUZERNE COUNTY, PENNSYLVANIA

Location:	MW-02I	MW-02S	MW-02S	MW-02S	MW-02S	MW-02S	MW-02S
Sample ID:	MW-02I-20131223	MW-02S-20130627	MW-02S-20130805	MW-02S-20130910	MW-02S-20131017	MW-02S-20131114	MW-02S-20131223
Sample Date:	12/23/2013	6/27/2013	8/5/2013	9/9/2013 9/10/2013	10/17/2013	11/14/2013	12/17/2013 12/23/2013
FIELD PARAMETERS							
Chloride (mg/L)	40	20	15	40	3	20	40
Colorimeter (mg/L)	1.5	0.2	0	0.5	0	1.9	1.5
Conductivity (mS/cm)	0.128	0.043	0.047	0.046	0.054	0.046	0.031
Dissolved Oxygen (mg/L)	2.35	1.8	2.37	0.99	0.25	5.74	1.23
Oxidation-reduction Potential (mV)	289	167	223	323	174	164	310
pH (S.U.)	6.5	4.95	4.79	4.77	4.96	5.45	4.61
Temperature (°C)	11.63	18.06	17.5	16.06	15.45	12.82	8.2
Turbidity (NTU)	25.5	24.8	9.7	0.8	111	29.3	2.6

SUMMARY OF PROCESS MONITORING FIELD RESULTS
ROUND 2 INJECTIONS
VALMONT TCE SITE, WEST HAZLETON, LUZERNE COUNTY, PENNSYLVANIA

Location:	MW-06I	MW-06I	MW-06I	MW-06I	MW-06I	MW-06I	MW-06S
Sample ID:	MW-06I-20130627	MW-06I-20130805	MW-06I-20130910	MW-06I-20131017	MW-06I-20131114	MW-06I-20131223	MW-06S-20130627
Sample Date:	6/27/2013	8/5/2013	9/9/2013 9/10/2013	10/17/2013	11/14/2013	12/17/2013 12/23/2013	6/27/2013
FIELD PARAMETERS							
Chloride (mg/L)	40	35	40	10	30	20	115
Colorimeter (mg/L)	0.6	0	0.6	0.6	2	4.4	0.4
Conductivity (mS/cm)	0.095	0.109	0.08	0.133	0.121	0.052	0.41
Dissolved Oxygen (mg/L)	2.84	1.91	0.04	8.74	10.06	0.67	5.88
Oxidation-reduction Potential (mV)	208	123	242	49	113	182	191
pH (S.U.)	4.8	5.09	5.01	5.09	5.8	5.14	4.54
Temperature (°C)	17.71	14.72	18.5	14.92	12	7.43	19.03
Turbidity (NTU)	10.6	457	9.2	88.2	198	10.1	8.5

SUMMARY OF PROCESS MONITORING FIELD RESULTS
ROUND 2 INJECTIONS
VALMONT TCE SITE, WEST HAZLETON, LUZERNE COUNTY, PENNSYLVANIA

Location:	MW-06S	MW-06S	MW-06S	MW-06S
Sample ID:	MW-06S-20130805	MW-06S-20130910	MW-06S-20131017	MW-06S-20131114
Sample Date:	8/5/2013	9/9/2013 9/10/2013	10/17/2013	11/14/2013
FIELD PARAMETERS				
Chloride (mg/L)	130	200	90	140
Colorimeter (mg/L)	0.3	0.6	0.7	0.9
Conductivity (mS/cm)	0.372	0.398	0.408	0.355
Dissolved Oxygen (mg/L)	10.07	3.15	1.55	9.51
Oxidation-reduction Potential (mV)	282	244	285	248
pH (S.U.)	4.3	4.47	4.52	4.67
Temperature (°C)	15.32	24.25	15.05	12.39
Turbidity (NTU)	10.1	25.8	18.5	134

SUMMARY OF PROCESS MONITORING FIELD RESULTS
ROUND 2 INJECTIONS
VALMONT TCE SITE, WEST HAZLETON, LUZERNE COUNTY, PENNSYLVANIA

Location:	MW-06S	MW-10A	MW-10A	MW-10A	MW-10A	MW-10A	MW-10B
Sample ID:	MW-06S-20131223	MW-10A-20130805	MW-10A-20130909	MW-10A-20131017	MW-10A-20131114	MW-10A-20131223	MW-10B-20130627
Sample Date:	12/17/2013 12/23/2013	8/5/2013	9/9/2013	10/17/2013	11/14/2013	12/18/2013 12/23/2013	6/27/2013
FIELD PARAMETERS							
Chloride (mg/L)	120	50	100	60	65	80	15
Colorimeter (mg/L)	0.7	18.8	62.1	2.4	1.7	0.9	0.1
Conductivity (mS/cm)	0.214	0.614	0.155	0.496	0.441	0.35	0.107
Dissolved Oxygen (mg/L)	4.51	8.58	4.49	2.53	1.04	1.8	6.23
Oxidation-reduction Potential (mV)	352	462	637	493	425	370	213
pH (S.U.)	4.34	7.22	7.03	5.64	7.4	6.15	6.65
Temperature (°C)	10.16	18.52	14.01	16.02	11.8	10.14	18.43
Turbidity (NTU)	4.4	122	180	26.1	53.6	42	4.3

SUMMARY OF PROCESS MONITORING FIELD RESULTS
ROUND 2 INJECTIONS
VALMONT TCE SITE, WEST HAZLETON, LUZERNE COUNTY, PENNSYLVANIA

Location:	MW-10B	MW-10B	MW-10B	MW-10B	MW-10B	MW-10C	MW-10C
Sample ID:	MW-10B-20130805	MW-10B-20130909	MW-10B-20131017	MW-10B-20131114	MW-10B-20131223	MW-10C-20130627	MW-10C-20130805
Sample Date:	8/5/2013	9/9/2013	10/17/2013	11/14/2013	12/23/2013	6/27/2013	8/5/2013
FIELD PARAMETERS							
Chloride (mg/L)	20	40	6	15	20	35	15
Colorimeter (mg/L)	0.3	1	1	0.5	0	18.5	9.2
Conductivity (mS/cm)	0.137	0.038	0.156	0.123	0.156	0.148	1.4
Dissolved Oxygen (mg/L)	2.13	5.19	0.66	1.3	1.02	5.47	3.79
Oxidation-reduction Potential (mV)	361	458	457	114	308	544	375
pH (S.U.)	5.87	7.51	5.67	6.11	6.5	6.32	6.85
Temperature (°C)	15.43	14.02	14.92	12.27	12.39	17.76	15.62
Turbidity (NTU)	26.8	608	12.7	9.6	8.83	114	67.2

SUMMARY OF PROCESS MONITORING FIELD RESULTS
ROUND 2 INJECTIONS
VALMONT TCE SITE, WEST HAZLETON, LUZERNE COUNTY, PENNSYLVANIA

Location:	MW-10C	MW-10C	MW-10C	MW-10C	MW-11D	MW-11S	MW-11S
Sample ID:	MW-10C-20130909	MW-10C-20131017	MW-10C-20131114	MW-10C-20131223	MW-11D-20131219	MW-11S-20130627	MW-11S-20130805
Sample Date:	9/9/2013	10/17/2013	11/14/2013	12/18/2013 12/23/2013	12/19/2013	6/27/2013	8/5/2013
FIELD PARAMETERS							
Chloride (mg/L)	40	7.5	20	40	NA	50	40
Colorimeter (mg/L)	8.3	1	0.3	0	NA	100 >	60
Conductivity (mS/cm)	0.045	1.02	0.201	0.082	0.127	1.13	0.297
Dissolved Oxygen (mg/L)	6.18	1.85	2.63	0.46	3.02	3.28	2.8
Oxidation-reduction Potential (mV)	470	116	293	403	737	647	617
pH (S.U.)	7.63	6.77	8.15	5.09	5.76	6.02	6.78
Temperature (°C)	12.53	15.28	12.18	10.59	9.96	16.27	19.24
Turbidity (NTU)	223	29	56	1	45	385	77.3

SUMMARY OF PROCESS MONITORING FIELD RESULTS
ROUND 2 INJECTIONS
VALMONT TCE SITE, WEST HAZLETON, LUZERNE COUNTY, PENNSYLVANIA

Location:	MW-11S		MW-11S	MW-11S	MW-11S	MW-12I	MW-12I	MW-12I
Sample ID:	MW-11S-20130909		MW-11S-20131017	MW-11S-20131114	MW-11S-20131223	MW-12I-20130627	MW-12I-20130805	MW-12I-20130909
Sample Date:	9/9/2013		10/17/2013	11/14/2013	12/20/2013 12/23/2013	6/27/2013	8/5/2013	9/9/2013
FIELD PARAMETERS								
Chloride (mg/L)	NA		6	15	20	55	75	100
Colorimeter (mg/L)	100	>	7.6	4.5	0	0.8	0	1.1
Conductivity (mS/cm)	0.062		0.123	0.072	0.086	0.243	0.324	0.063
Dissolved Oxygen (mg/L)	6.35		1.42	2.35	5.42	3.66	1.86	4.42
Oxidation-reduction Potential (mV)	698		677	602	514	144	417	513
pH (S.U.)	6.22		6.14	6.64	5.34	6.43	6.51	7.77
Temperature (°C)	13.24		15.46	10.56	9.85	21.27	17.14	12.43
Turbidity (NTU)	107		99.1	56.9	5.5	62.9	32.9	306

SUMMARY OF PROCESS MONITORING FIELD RESULTS
ROUND 2 INJECTIONS
VALMONT TCE SITE, WEST HAZLETON, LUZERNE COUNTY, PENNSYLVANIA

Location:	MW-12I	MW-12I	MW-12I	MW-12S	MW-13I	MW-13I	MW-13I
Sample ID:	MW-12I-20131017	MW-12I-20131114	MW-12I-20131223	MW-12S-20131219	MW-13I-20130627	MW-13I-20130805	MW-13I-20130909
Sample Date:	10/17/2013	11/14/2013	12/23/2013	12/19/2013	6/27/2013	8/5/2013	9/9/2013
FIELD PARAMETERS							
Chloride (mg/L)	45	90	80	80	40	20	40
Colorimeter (mg/L)	0.6	2	2.8	2.8	0.6	0	32.6
Conductivity (mS/cm)	0.279	0.309	0.297	4.73	0.067	0.064	0.017
Dissolved Oxygen (mg/L)	1.07	1.16	1.19	1.15	1.16	9.5	10.45
Oxidation-reduction Potential (mV)	559	611	597	633	510	650	695
pH (S.U.)	5.76	6.51	6.43	7.31	5.17	4.89	6.23
Temperature (°C)	18.48	11.45	12.47	10.45	17.85	16.1	13.83
Turbidity (NTU)	87.8	64.1	19.2	21	20.9	34.1	66.8

SUMMARY OF PROCESS MONITORING FIELD RESULTS
ROUND 2 INJECTIONS
VALMONT TCE SITE, WEST HAZLETON, LUZERNE COUNTY, PENNSYLVANIA

Location:	MW-13I	MW-13I	MW-13I	MW-13S	MW-13S	MW-13S	MW-13S
Sample ID:	MW-13I-20131017	MW-13I-20131114	MW-13I-20131223	MW-13S-20130627	MW-13S-20130805	MW-13S-20130910	MW-13S-20131017
Sample Date:	10/17/2013	11/14/2013	12/23/2013	6/27/2013	8/5/2013	9/9/2013 9/10/2013	10/17/2013
FIELD PARAMETERS							
Chloride (mg/L)	6	15	20	70	20	40	5
Colorimeter (mg/L)	70	0.4	1.2	44.9	0	1	0.7
Conductivity (mS/cm)	0.187	0.044	0.058	0.216	0.087	0.088	0.091
Dissolved Oxygen (mg/L)	1.12	1.73	0.83	3.38	10.1	0.13	1.79
Oxidation-reduction Potential (mV)	711	189	464	602	569	324	204
pH (S.U.)	5.34	5.51	5.25	6.28	5.34	5.46	5.5
Temperature (°C)	16.07	12.15	12.18	18.39	15.52	23.37	15.23
Turbidity (NTU)	998	16.8	11.9	71000	50.7	69.6	26.2

SUMMARY OF PROCESS MONITORING FIELD RESULTS
ROUND 2 INJECTIONS
VALMONT TCE SITE, WEST HAZLETON, LUZERNE COUNTY, PENNSYLVANIA

Location:	MW-13S	MW-13S
Sample ID:	MW-13S-20131114	MW-13S-20131223
Sample Date:	11/14/2013	12/17/2013 12/23/2013
FIELD PARAMETERS		
Chloride (mg/L)	10	20
Colorimeter (mg/L)	0.5	1.4
Conductivity (mS/cm)	0.067	0.064
Dissolved Oxygen (mg/L)	1.06	2.97
Oxidation-reduction Potential (mV)	146	306
pH (S.U.)	5.89	4.75
Temperature (°C)	12.59	10.34
Turbidity (NTU)	167	5

SUMMARY OF PROCESS MONITORING FIELD RESULTS
ROUND 2 INJECTIONS
VALMONT TCE SITE, WEST HAZLETON, LUZERNE COUNTY, PENNSYLVANIA

Location:	MW-15D	MW-15D	MW-15D	MW-15D	MW-15D	MW-15D	MW-15S
Sample ID:	MW-15D-20130627	MW-15D-20130805	MW-15D-20130909	MW-15D-20131017	MW-15D-20131114	MW-15D-20131223	MW-15S-20130627
Sample Date:	6/27/2013	8/5/2013	9/9/2013	10/17/2013	11/14/2013	12/23/2013	6/27/2013
FIELD PARAMETERS							
Chloride (mg/L)	15	10	20	7.5	10	40	15
Colorimeter (mg/L)	2.8	0.4	1.4	0.9	0	0	0.6
Conductivity (mS/cm)	0.153	0.156	0.1	0.285	0.244	0.324	0.025
Dissolved Oxygen (mg/L)	3.71	3.15	4.96	8	1.46	1.49	3.33
Oxidation-reduction Potential (mV)	500	466	450	438	169	262	148
pH (S.U.)	5.47	5.67	6.18	5.75	6.46	6.2	5.48
Temperature (°C)	17.99	13.78	12.14	15.32	11.27	11.66	18.89
Turbidity (NTU)	54.5	65.7	112	11.8	12.4	7.2	0

SUMMARY OF PROCESS MONITORING FIELD RESULTS
ROUND 2 INJECTIONS
VALMONT TCE SITE, WEST HAZLETON, LUZERNE COUNTY, PENNSYLVANIA

Location:	MW-15S	MW-15S	MW-15S	MW-15S
Sample ID:	MW-15S-20130805	MW-15S-20130909	MW-15S-20131017	MW-15S-20131114
Sample Date:	8/5/2013	9/9/2013	10/17/2013	11/14/2013
FIELD PARAMETERS				
Chloride (mg/L)	10	40	3.6	15
Colorimeter (mg/L)	0.1	0.9	0.9	0
Conductivity (mS/cm)	0.041	0.007	0.039	0.033
Dissolved Oxygen (mg/L)	3.41	5.64	1.32	1.47
Oxidation-reduction Potential (mV)	474	484	658	402
pH (S.U.)	4.96	7.31	6.29	6.57
Temperature (°C)	15.14	13.68	16.34	11.69
Turbidity (NTU)	15.7	105	15.1	7.8

SUMMARY OF PROCESS MONITORING FIELD RESULTS
ROUND 2 INJECTIONS VALMONT TCE SITE, WEST HAZLETON, LUZERNE COUNTY, PENNSYLVANIA

Location:	MW-15S	MW-18S	MW-18S	MW-18S	MW-22D	MW-22D	MW-22D
Sample ID:	MW-15S-20131223	MW-18S-20131017	MW-18S-20131114	MW-18S-20131223	MW-22D-20130627	MW-22D-20130805	MW-22D-20130909
Sample Date:	12/23/2013	10/17/2013	11/14/2013	12/20/2013 12/23/2013	6/27/2013	8/5/2013	9/9/2013
FIELD PARAMETERS							
Chloride (mg/L)	20	200 >	50	40	60	45	NA
Colorimeter (mg/L)	0.7	100 >	20	4.3	63.2	60.7	64.5
Conductivity (mS/cm)	0.043	0.485	0.36	0.157	0.126	0.149	0.034
Dissolved Oxygen (mg/L)	1.58	2.86	4.86	7.65	11.13	6.95	8.99
Oxidation-reduction Potential (mV)	341	720	686	685	525	555	566
pH (S.U.)	5.8	5.92	6.54	5.7	6.44	7.13	8.04
Temperature (°C)	11.91	17.57	12.78	14.56	20.41	16.43	13.69
Turbidity (NTU)	6.56	81.8	160	984	18.4	26.8	23.8

SUMMARY OF PROCESS MONITORING FIELD RESULTS
ROUND 2 INJECTIONS VALMONT TCE SITE, WEST HAZLETON, LUZERNE COUNTY, PENNSYLVANIA

Location:	MW-22D	MW-22D	MW-28I	MW-28I	MW-28I	MW-28I	MW-28I	MW-28I
Sample ID:	MW-22D-20131017	MW-22D-20131114	MW-28I-20130627	MW-28I-20130805	MW-28I-20130909	MW-28I-20131017	MW-28I-20131114	MW-28I-20131223
Sample Date:	10/17/2013	11/14/2013	6/27/2013	8/5/2013	9/9/2013	10/17/2013	11/14/2013	12/23/2013
FIELD PARAMETERS								
Chloride (mg/L)	200	60	20	25	40	6.5	15	200
Colorimeter (mg/L)	67.4	61.2	0.1	0	0.6	0.8	0.2	2.1
Conductivity (mS/cm)	0.148	0.137	0.136	0.169	0.047	0.245	0.168	0.626
Dissolved Oxygen (mg/L)	6.52	7.09	2.73	2.91	10.82	1.4	1.71	2.48
Oxidation-reduction Potential (mV)	612	616	249	397	370	467	263	96
pH (S.U.)	6.21	6.31	6.44	5.86	7.24	5.75	7.05	8.99
Temperature (°C)	17.06	11.04	18.65	15.32	13.06	17.42	12.91	12.72
Turbidity (NTU)	9.3	34.7	6	50.4	30.3	46.6	270	11.92

SUMMARY OF PROCESS MONITORING FIELD RESULTS
ROUND 2 INJECTIONS VALMONT TCE SITE, WEST HAZLETON, LUZERNE COUNTY, PENNSYLVANIA

Location:	MW-28S	MW-28S	MW-28S	MW-28S	MW-28S
Sample ID:	MW-28S-20130805	MW-28S-20130909	MW-28S-20131017	MW-28S-20131114	MW-28S-20131223
Sample Date:	8/5/2013	9/9/2013	10/17/2013	11/14/2013	12/19/2013 12/23/2013
FIELD PARAMETERS					
Chloride (mg/L)	60	60	140	40	60
Colorimeter (mg/L)	0.2	70.1	31.8	44.1	0.4
Conductivity (mS/cm)	0.191	0.068	0.22	0.168	0.178
Dissolved Oxygen (mg/L)	6.07	4.94	0.85	2	9.02
Oxidation-reduction Potential (mV)	408	632	686	674	627
pH (S.U.)	5.67	7.56	6.06	6.18	5.84
Temperature (°C)	15.21	13.7	17.83	13.46	13.26
Turbidity (NTU)	50.5	259	23.3	627	26

DATA SUMMARY OF PROCESS MONITORING FIELD RESULTS
VALMONT TCE SITE, WEST HAZLETON, LUZERNE COUNTY, PENNSYLVANIA

Data Qualifiers:

> -- Greater than.

NA -- No result is available/applicable for this parameter in this sample.

Database source file: H:\VALMONT\DATA SUMMARIES\PIM RESULTS\FIELDDATA.DBF data retrieved on: 02/07/14

APPENDIX C

ROUND 2 PERFORMANCE MONITORING ANALYTICAL DATA SUMMARY

SUMMARY OF VOLATILE ORGANIC COMPOUND RESULTS
SEPTEMBER 2013 GROUNDWATER SAMPLES
VALMONT TCE SITE, WEST HAZLETON, PENNSYLVANIA

Location:	E-8		GW-9		GW-21		MW-02S		MW-02S-D		MW-6S		MW-6I		MW-11D		MW-11S		MW-13S		RB-01		TB-01	
Sample Date:	9/10/2013		9/10/2013		9/11/2013		9/10/2013		9/10/2013		9/10/2013		9/10/2013		9/11/2013		9/11/2013		9/10/2013		9/11/2013		9/10/2013	
Duplicate of:									MW-02S															
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
1,1,1-Trichloroethane	21		9.1		7.6		10		8.8		2	J	8.1		6		500		13		5	U	5	U
1,1,2,2-Tetrachloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloro-1,2,2-trifluoroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	9		5	U	5	U	5	U
1,1,2-Trichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	R	5	R	5	U	5	U	5	U
1,1-Dichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5.7		1.3	J	5	U	5	U
1,1-Dichloroethene	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	UJ	5	UJ	5	U	5	U	5	U
1,2,3-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2,4-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromo-3-chloropropane	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromoethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethene (cis)	5	U	3.6	J	5	U	5	U	5	U	5	U	5	U	5	UJ	5	UJ	59		5	U	5	U
1,2-Dichloroethene (trans)	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	UJ	5	UJ	5	U	5	U	5	U
1,2-Dichloropropane	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,3-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,4-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,4-Dioxane	100	U	100	U	100	U	100	U	100	U	100	U	100	U	100	U	100	U	100	U	100	U	100	U
2-Butanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2-Hexanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
4-Methyl-2-pentanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Acetone	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	38		10	U	10	U	10	U
Benzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromochloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromodichloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromoform	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromomethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	2.2	J
Carbon Disulfide	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Carbon Tetrachloride	5	UJ	5	UJ	5	UJ	5	UJ	5	UJ	5	UJ	5	UJ	5	UJ	5	UJ	5	U	5	UJ	5	U
Chlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroform	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
cis-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	R	5	R	5	U	5	U	5	U
Cyclohexane	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Dibromochloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Dichlorodifluoromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Ethylbenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Isopropylbenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
M,p-xylene	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methyl Acetate	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methyl Tert-butyl Ether	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methylcyclohexane	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methylene Chloride	1.1	J	1.3	J	1.2	J	1.3	J	1.2	J	1.2	J	1.4	J	5	U	5	U	1.8	J	1.5	J	1.6	J

SUMMARY OF VOLATILE ORGANIC COMPOUND RESULTS
SEPTEMBER 2013 GROUNDWATER SAMPLES
VALMONT TCE SITE, WEST HAZLETON, PENNSYLVANIA

Location:	E-8		GW-9		GW-21		MW-02S		MW-02S-D		MW-6S		MW-6I		MW-11D		MW-11S		MW-13S		RB-01		TB-01	
Sample Date:	9/10/2013		9/10/2013		9/11/2013		9/10/2013		9/10/2013		9/10/2013		9/10/2013		9/11/2013		9/11/2013		9/10/2013		9/11/2013		9/10/2013	
Duplicate of:									MW-02S															
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
1,1,1-Trichloroethane	21		9.1		7.6		10		8.8		2	J	8.1		6		500		13		5	U	5	U
O-xylene	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Styrene	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Tetrachloroethene	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Toluene	5	U	2.4	J	1.5	J	4.7	J	3.5	J	4	J	3.7	J	1.4	J	2.5	J	2.7	J	4.1	J	3.7	J
trans-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	R	5	R	5	U	5	U	5	U
Trichloroethene	250		280		160		55		48		48		30		5	U	3.8	J	480		5	U	5	U
Trichlorofluoromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Vinyl Chloride	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	UJ	5	UJ	5	U	5	U	5	U

DATA SUMMARY OF VOLATILE ORGANIC COMPOUND RESULTS
OCTOBER 2013 GROUNDWATER SAMPLES
VALMONT TCE SITE, WEST HAZLETON, PENNSYLVANIA

Data Qualifiers:

J -- Value is considered estimated due to exceedance of technical quality control criteria or because result is less than the Contract Required Quantitation Limit (CRQL).

R -- Positive result is considered unusable due to exceedance of technical quality control criteria.

U -- Value is a non-detected result as reported by the laboratory.

UJ -- Non-detected result is considered estimated due to exceedance of technical quality control criteria.

Database source file: H:\VALMONT\DATA SUMMARIES\PIM RESULTS\SEP13.DBF data retrieved on: 11/04/13

SUMMARY OF VOLATILE ORGANIC COMPOUND RESULTS
DECEMBER 2013 GROUNDWATER SAMPLES
VALMONT TCE SITE, WEST HAZLETON, PENNSYLVANIA

Sample ID:	E-02		E-04		E-05		E-07		E-08		E-09		GW-09		DUP-01		GW-21		MW-02S		MW-06I		MW-06S	
Sample Date:	12/19/2013		12/20/2013		12/18/2013		12/19/2013		12/18/2013		12/18/2013		12/17/2013		12/17/2013		12/17/2013		12/17/2013		12/17/2013		12/17/2013	
Duplicate of:															GW-09									
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
1,1,1-Trichloroethane	25		13		2.4	J	5.9		18		41	J	4.5	J	4.7	J	3.4	J	6.6		3.2	J	1.3	J
1,1,2,2-Tetrachloroethane	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloro-1,2,2-trifluoroethane	1.4	J	0.84	J	5	U	0.97	J	0.42	J	15	J	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloroethane	5	U	0.35	J	5	U	5	U	5	U	25	J	5	U	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethane	1.2	J	0.5	J	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethene	3.1	J	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2,3-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2,4-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromo-3-chloropropane	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromoethane	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethane	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethene (cis)	10		2.5	J	5	U	0.69	J	1.5	J	6.4	J	3	J	2.7	J	0.7	J	0.32	J	5	U	0.44	J
1,2-Dichloroethene (trans)	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloropropane	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
1,3-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
1,4-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
1,4-Dioxane	100	R	100	R	100	R	100	R	100	R	2000	R	100	R	100	R	100	R	100	R	100	R	100	R
2-Butanone	10	U	10	U	10	U	10	U	10	U	200	U	10	U	10	U	10	U	10	U	10	U	10	U
2-Hexanone	10	U	10	U	10	U	10	U	10	U	200	U	10	U	10	U	10	U	10	U	10	U	10	U
4-Methyl-2-pentanone	10	U	10	U	10	U	10	U	10	U	200	U	10	U	10	U	10	U	10	U	10	U	10	U
Acetone	10	U	10	U	3.1	J	10	U	1.3	J	64	J	1.3	J	1.5	J	10	U	10	U	10	U	10	U
Benzene	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromochloromethane	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromodichloromethane	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromoform	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromomethane	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Carbon Disulfide	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Carbon Tetrachloride	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Chlorobenzene	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroethane	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroform	5	U	3.2	J	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloromethane	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
cis-1,3-Dichloropropene	5	U	5	UJ	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Cyclohexane	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Dibromochloromethane	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Dichlorodifluoromethane	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Ethylbenzene	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Isopropylbenzene	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
M,p-xylene	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Methyl Acetate	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Methyl Tert-butyl Ether	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Methylcyclohexane	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U

SUMMARY OF VOLATILE ORGANIC COMPOUND RESULTS
DECEMBER 2013 GROUNDWATER SAMPLES
VALMONT TCE SITE, WEST HAZLETON, PENNSYLVANIA

Sample ID:	E-02		E-04		E-05		E-07		E-08		E-09		GW-09		DUP-01		GW-21		MW-02S		MW-06I		MW-06S	
Sample Date:	12/19/2013		12/20/2013		12/18/2013		12/19/2013		12/18/2013		12/18/2013		12/17/2013		12/17/2013		12/17/2013		12/17/2013		12/17/2013		12/17/2013	
Duplicate of:															GW-09									
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Methylene Chloride	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
O-xylene	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Styrene	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Tetrachloroethene	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Toluene	5	U	5	U	5	U	5	U	5	U	25	J	5	U	5	U	5	U	5	U	5	U	5	U
trans-1,3-Dichloropropene	5	U	5	UJ	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Trichloroethene	450		250		19		190		170		9200		150		160		73		35		14		27	
Trichlorofluoromethane	5	U	5	U	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U
Vinyl Chloride	5	U	5	UJ	5	U	5	U	5	U	100	U	5	U	5	U	5	U	5	U	5	U	5	U

SUMMARY OF VOLATILE ORGANIC COMPOUND RESULTS
DECEMBER 2013 GROUNDWATER SAMPLES
VALMONT TCE SITE, WEST HAZLETON, PENNSYLVANIA

Sample ID:	MW-10A		MW-10C		MW-11D		MW-11S		DUP-02		MW-12S		MW-13S		MW-18S		MW-28S		RB-01		TB-01		TB-02	
Sample Date:	12/18/2013		12/18/2013		12/19/2013		12/20/2013		12/20/2013		12/19/2013		12/17/2013		12/20/2013		12/19/2013		12/18/2013		12/17/2013		12/19/2013	
Duplicate of:									MW-11S															
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
1,1,1-Trichloroethane	16		1.5	J	27		220		210		50		4.7	J	1.1	J	82		5	U	5	U	5	U
1,1,2,2-Tetrachloroethane	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloro-1,2,2-trifluoroethane	1.8	J	5	U	1.1	J	16	J	15	J	5.8		5	U	5	U	1.8	J	5	U	5	U	5	U
1,1,2-Trichloroethane	5	U	5	U	5	U	50	U	50	U	0.7	J	5	U	5	UJ	5	U	5	U	5	U	5	U
1,1-Dichloroethane	0.89	J	5	U	0.42	J	50	U	50	U	0.87	J	5	U	5	U	1.2	J	5	U	5	U	5	U
1,1-Dichloroethene	5	U	5	U	5	U	20	J	21	J	5	U	2.4	J	5	U	6		5	U	5	U	5	U
1,2,3-Trichlorobenzene	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2,4-Trichlorobenzene	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromo-3-chloropropane	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromoethane	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichlorobenzene	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethane	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethene (cis)	4.1	J	5	U	0.76	J	47	J	46	J	5	U	26		5	U	15		5	U	5	U	5	U
1,2-Dichloroethene (trans)	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloropropane	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,3-Dichlorobenzene	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,4-Dichlorobenzene	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,4-Dioxane	100	R	100	R	100	R	1000	R	1000	R	100	R	100	R	100	R	100	R	100	R	100	R	100	R
2-Butanone	10	U	10	U	2.8	J	100	U	100	U	4.8	J	10	U	10	U	10	U	10	U	10	U	2	J
2-Hexanone	10	U	10	U	10	U	100	U	100	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
4-Methyl-2-pentanone	10	U	10	U	10	U	100	U	100	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Acetone	4.5	J	5.9	J	31		100	U	100	U	43		1.3	J	21		24		3.2	J	3.1	J	5.3	J
Benzene	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromochloromethane	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromodichloromethane	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromoform	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromomethane	5	U	5	U	5	U	50	U	50	U	5	U	5	U	1.1	J	5	U	5	U	5	U	5	U
Carbon Disulfide	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Carbon Tetrachloride	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chlorobenzene	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroethane	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroform	1.7	J	5	U	5	U	50	U	50	U	1.7	J	5	U	5	U	1.1	J	5	U	5	U	5	U
Chloromethane	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
cis-1,3-Dichloropropene	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	UJ	5	U	5	U	5	U	5	U
Cyclohexane	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Dibromochloromethane	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Dichlorodifluoromethane	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Ethylbenzene	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Isopropylbenzene	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
M,p-xylene	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methyl Acetate	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methyl Tert-butyl Ether	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methylcyclohexane	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U

SUMMARY OF VOLATILE ORGANIC COMPOUND RESULTS
DECEMBER 2013 GROUNDWATER SAMPLES
VALMONT TCE SITE, WEST HAZLETON, PENNSYLVANIA

Sample ID:	MW-10A		MW-10C		MW-11D		MW-11S		DUP-02		MW-12S		MW-13S		MW-18S		MW-28S		RB-01		TB-01		TB-02	
Sample Date:	12/18/2013		12/18/2013		12/19/2013		12/20/2013		12/20/2013		12/19/2013		12/17/2013		12/20/2013		12/19/2013		12/18/2013		12/17/2013		12/19/2013	
Duplicate of:									MW-11S															
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Methylene Chloride	5	U	5	U	5	U	50	U	50	U	5	U	5	U	0.42	J	5	U	5	U	5	U	5	U
O-xylene	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Styrene	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Tetrachloroethene	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Toluene	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
trans-1,3-Dichloropropene	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	UJ	5	U	5	U	5	U	5	U
Trichloroethene	210		5	U	61		3000		2600		5	U	150		5	U	500		5	U	5	U	5	U
Trichlorofluoromethane	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Vinyl Chloride	5	U	5	U	5	U	50	U	50	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U

DATA SUMMARY OF VOLATILE ORGANIC COMPOUND RESULTS
DECEMBER 2013 GROUNDWATER SAMPLES
VALMONT TCE SITE, WEST HAZLETON, PENNSYLVANIA

Data Qualifiers:

J -- Value is considered estimated due to exceedance of technical quality control criteria or because result is less than the Contract Required Quantitation Limit (CRQL).

R -- Positive result is considered unusable due to exceedance of technical quality control criteria.

U -- Value is a non-detected result as reported by the laboratory.

UJ -- Non-detected result is considered estimated due to exceedance of technical quality control criteria.

Database source file: H:\VALMONT\DATA SUMMARIES\PIM RESULTS\DEC13.DBF data retrieved on: 01/14/14

APPENDIX D

POSSIBLE ROUND 3 ISCO INJECTION APPROACH

POSSIBLE ROUND 3 ISCO INJECTION APPROACH
VALMONT TCE SITE
WEST HAZLETON BOROUGH AND HAZLE TOWNSHIP, PENNSYLVANIA

1.0 OVERVIEW

EPA and Tetra Tech continue to implement the long-term remedial action (LTRA) at the Valmont TCE Site based on ISCO technology as outlined in the Record of Decision (EPA, January 2011). Round 1 ISCO injections were performed in September 2011, while Round 2 injections were conducted in May 2013. Post-injection monitoring followed the Round 2 injections and was completed in December 2013. This enclosure provides information regarding the possible approach for implementing the next round of the ISCO remedy (Round 3) based on current TCE concentrations, post-injection monitoring results, and past ISCO injection events.

2.0 SCOPE OF WORK

The proposed scope of work for Round 3 may include:

- Installation of one or more new injection wells, particularly inside the existing building.
- Treatment at shallow wells currently containing at least 500 micrograms/liter (µg/L) of TCE (e.g., wells MW-10A, MW-11S, MW-28S, and possibly E-2).
- Treatment at deeper wells containing more than 100 µg/L of TCE (e.g., MW-11, MW-22D, E-4, E-6, E-7, E-9, and possibly E-3).
- Injection of oxidant solution into other selected existing wells and intervals.
- Use of RemOx® sustained-released (SR) permanganate in a wax candle-type matrix, particularly for selected wells in the adjacent neighborhood.
- Post-injection or post-treatment monitoring and reporting.

A total of 11 wells have been selected to conduct injections at the site. Up to two zones (or intervals) will be utilized per well. Tetra Tech assumes that a double packer assembly will be used for most injections and that each packer will be inflated to the appropriate pressure for each zone. The assembly will be constructed to include a 10- to 20-foot spread between packers.

Water-level measurements and pressure readings will be taken from the injection well along with measurements from nearby wells to determine the influence of the injected volume of oxidant solution.

Tetra Tech assumes that concentrated 10% sodium permanganate ($NaMnO_4$) solution will be utilized for the injections at the site. The Tetra Tech field representative will make the final decision on all safety procedures. All Subcontractor personnel shall be required to attend a brief lecture on site-specific safety, to be given just before the commencement of work.

2.1 Task 1 - Mobilization/Demobilization

This task includes mobilizing all equipment, materials, and labor required to complete the project to the jobsite; setup of an equipment lay down area; per diem for a field crew, as needed; attendance of an approximately 1-hour site-specific health and safety meeting and compliance with all health and safety requirements for the project; site clean-up; demobilization from the site; and any other work items not mentioned in the remaining work tasks but necessary for the performance of the work activities.

A site-specific health and safety orientation meeting will be held during mobilization, prior to the initiation of any on-site activities. All Subcontractors shall meet the requirements of both OSHA 1910.120 and Tetra Tech as set forth in the Health and Safety Plan (HASP) (Tetra Tech, April 2011). The HASP will be available for review upon request. One orientation meeting will be held and all Subcontractor representatives and potential substitute personnel performing on-site work activities will be required to attend. No substitute personnel will be allowed to work without training. Personnel decontamination is discussed in the HASP.

The Drilling Subcontractor will provide 55-gallon drums for wastewater/decontamination water generated during injection activities. The drums will be stored at a centrally located area. It will be the responsibility of the Subcontractor to provide temporary, mobile holding tanks to support the following work:

- Collect and transport water and decontamination fluids
- Collect and transport the oxidant solution to locations near the selected injection wells
- Collect, haul, and transfer wastewater to the staging area

The Drilling Subcontractor will be responsible for providing and operating pumps for transferring wastewater on site. It is likely that any residual materials from injection activities will need to be contained and transported back to a central marshaling area.

2.2 Task 2 - Installation of New Wells

Portions of the VOC-contaminated plume attributable to the Site are apparently not being adequately addressed by past ISCO injections. To meet the RA objectives, one new well (E-10) will be installed near the loading docks of the existing building. ISCO injections into well E-10 will destroy elevated concentrations in this general area, as measured by contaminant levels at wells MW-11S, MW-11D, MW-28S, and MW-28I (Figure D-1).

Based on direction from EPA, a second new injection well (E-11) may be drilled near well cluster MW-13 along the western side of the building, or just inside the building in this area. Injections at well E-11 will degrade VOCs upgradient of wells MW-13S and MW-13I.

Prior to well drilling, all new locations will be cleared for buried utilities and subsurface features. The new wells will be drilled, developed, and constructed in a manner similar to the existing injection wells. If necessary, these wells will be flush mounted. For planning, the new wells will be cased roughly 20 feet below the ground or floor surface, and advanced to at least 100 feet. These wells will be geophysically logged as described in Section 2.3. Samples from these new wells will be analyzed for Target Compound List volatile organic compounds (TCL VOCs), chloride, and general chemistry.

2.3 Task 3 - Borehole Geophysical Logging

The purpose of this task is to evaluate the new wells (E-10 and E-11) as well as the condition of two existing wells for future injection work. Borehole geophysical logging may be required for two former residential wells (i.e., GW-21 and GW-23) along Bent Pine Trail/Road. Both wells are 6-inch open boreholes with estimated depths between 180 and 190 feet. Traditional borehole geophysical logging methods will be used for this task, including:

- Gamma ray
- Temperature
- Fluid resistivity
- Heat pulse flowmeter
- Normal resistivity
- Acoustic televiewer
- Caliper

The geophysical logs and video logs shall be reviewed by the Tetra Tech field representative immediately after their generation. The Subcontractor shall supply the equipment necessary to view the video.

At this time, packer tests are not considered part of the Round 3 scope of work, if directed by EPA, packer tests will be conducted to obtain water quality and yield information from discrete groundwater zones encountered within wells E-10, E-11, GW-21, and GW-23. The zone(s) to be tested within the borehole will be identified by reviewing borehole geophysical logs.

If directed to perform packer tests, a dual-packer assembly will be required, although only the upper packer may be needed for some tests conducted near the bottom of the borehole. The standard packer spread (measured from the bottom of the top packer to the top of the bottom packer) will be about 10 feet. However, it is possible that a longer or shorter spread will be required depending on the vertical distribution of fractures and the need to either include or exclude selected fractures from each test. Therefore, the spread of the packers will be adjustable so that discrete zones of varying length can be isolated in the borehole. To minimize the number of packer adjustments, packer testing will be designed to first test all zones requiring the standard packer spread, and then test the zones requiring a shorter or longer packer spread.

Hydraulic head monitoring of the formation above and below the packer will be conducted during the packer tests. The yields from the isolated fractures are estimated to range from less than 1 to 3 gallon per minutes. The Subcontractor will supply either a variable speed pump or a low-yield pump to evacuate the packered interval, so estimates of approximate yield may be made, and groundwater samples to be analyzed for volatile organic contaminants may be obtained directly from the pump discharge.

2.4 Task 4 - Low to Moderate ISCO Pressure Injections

Selected wells will be identified for low/moderate pressure injections of the oxidant solution. These injections will be similar to those conducted during Round 2. For planning, wells located north of the groundwater divide and within the property boundary of the former Chromatex Plant #2 will be targeted. Other wells located south of the divide and within the neighborhood will be selected for the use of sustained-released permanganate (Task 5).

The Drilling Subcontractor will provide all equipment, materials, and labor required to set up all of the required injection equipment at the site and to conduct any preliminary tasks to ensure meeting the objectives of the work. Initial activities may include any necessary trial runs or pilot testing to ensure that the oxidant solution can be successfully injected.

The Drilling Subcontractor will provide all equipment, materials, and labor required to perform injection activities at selected depths within the injection wells, including, but not limited to a portable 500 gallon permanganate holding tank, a double packer assembly (with 10-foot and 20-foot spreads), a suitable power source, water injection pumps capable of and suitable for injecting the oxidant solution under

pressures ranging up to 200 psi and at depths ranging up to 100 feet, all required piping, pressure gauges and flow meters, and any necessary materials required to complete the injections.

The general procedure for each injection includes isolating the desired depth interval using a set of inflatable or mechanical packers (e.g., 5-foot packer), pumping the $NaMnO_4$ solution into the target interval under increasing pressures until a maximum pressure of approximately 150 psi occurs, continuing to inject the solution until the required volume has been injected into the specified interval. This procedure will be repeated for each targeted depth zone within the well typically starting with the deepest zone and working down to the shallowest.

The $NaMnO_4$ solution will be purchased by Tetra Tech and will be stored in a 5,000-gallon poly tank. This tank will be positioned at a centrally located area of the site, most likely near well cluster MW-11. The oxidant solution will be pumped from the tank by the subcontractor into portable 500-gallon poly tank(s) and transferred to each injection well location as necessary. The 5,000-gallon tank will have secondary containment using dimensional lumber and plastic sheeting.

Work will begin at well E-2 and continue through well E-10. Well E-9 will be the last well used for injections. These wells are 8-inch diameter open-borehole wells. A dual packer assembly will generally be used for these wells. The packer inflation pressures will be at least 2,000 psi. The pressure generated during injections may be up to 150 psi. However, the pumps used by the Drilling Subcontractor must be capable of achieving this depth at up to 100 feet below ground surface. The pressure and flow will be monitored by the use of in line gauges/meters. The total volume of oxidant solution to be injected into each 8-inch well zone is shown in Table 2.

Work will then continue at the monitoring wells listed in Table 2. These wells are 2-inch diameter screened polyvinyl chloride (PVC) wells. A single packer assembly or a fitted connection (e.g., Fernco) may be used within each well. The packer inflation will be of sufficient pressure to complete each injection without damaging the PVC casing and at the same time preventing any day lighting of the injection solution.

The Subcontractor must demonstrate that the fitted connection (if used) provides a comparable measure of effectiveness for injections into monitoring wells. Two measures of effectiveness are the capability of the fitted connection to prevent surfacing of the oxidant solution as well as to allow for pressure injections into low yielding wells.

The Subcontractor must demonstrate that the fitted connection will meet the objectives of the injection program. Leak testing using only water must be performed to fulfill this demonstration. If the 2-inch PVC

riser is damaged, or if leak testing is unsuccessful, the single packer approach will be used. The Tetra Tech field representative, and not the Subcontractor, is responsible for making the decision as to whether the fitted connection is appropriate.

Prior to the start of injections at individual wells, the field team will place pressure transducers in nearby wells to monitor relative changes in water-level elevations. Tetra Tech will use the pressure transducer results to evaluate the radius of influence (ROI) associated with injections. For planning, Tetra Tech assumes that up to six transducers will be used during the course of the Round 3 ISCO injections as follows:

PRESSURE TRANSDUCERS							
E-2	**E-3**	**E-4**	**E-6**	**E-7**	**E-8**	**E-9**	**E-10 (NEW)**
MW-11S MW-11D MW-15S MW-15I MW-28S E-8	MW-12S MW-12I MW-18 E-6	MW-28S MW-28I MW-15S MW-15I	MW-18S MW-12S MW-12I E-9 MW-28S MW-28I	MW-15S MW-15D MW-6S MW-6I	E-2 E-10 MW-11S MW-11D	E-6 MW-18S MW-28S MW-28I	MW-11S MW-11D E-2 E-8 MW-28S MW-28I

PRESSURE TRANSDUCERS						
MW-10A	**MW-11S**	**MW-11D**	**MW-12S**	**MW-28S**		
MW-10B MW-10C	MW-11D MW-15S MW-28S E-8	MW-15D MW-28I E-8 MW-15S	E-3 MW-12I MW-18S E-6	MW-28I MW-11S MW-15S MW-15D		

The field team will stop injections in the event that receiving wells indicate that surfacing of the oxidant solution may occur (also referred to as day lighting). Tetra Tech will adjust the flow rate of the injection pump to allow for stabilization of the water level in each receiving well, to obtain a consistent flow of oxidant solution, and to prevent day lighting. Containment pads will be installed around the injection wells to contain any possible spills.

A dilute (3-6%) sodium thiosulfate solution will be available for neutralization of spills and decon of equipment. Sorbent materials such as vermiculate or kitty litter will also be available for spill containment. For personal decontamination, the team will use a dilute hydrogen peroxide/vinegar/water solution. The field team will containerize all wastes in 55-gallon drums for off-site disposal following completion of injection activities.

Round 3 ISCO injections may be limited by the amount of $NaMnO_4$ solution each receiving well can accept, particularly for screened monitoring wells. To the extent practicable, Tetra Tech will inject the volumes listed in Table 1. For planning, however, the following guidelines will support decision-making in the field regarding the injection program:

1. Surfacing of the oxidant solution will result in immediate cessation of injection activities at a well interval. The team will take precautions for those wells with two targeted intervals if the deepest interval injections previously resulted in surfacing.

2. Pressures greater than 150 psi will not be exceeded during injections. Well intervals unable to receive the oxidant solution at this pressure will not be used for injections.

3. For monitoring (screened) wells containing TCE concentrations greater than 500 ug/L and unable to receive an average flow rate of at least 2 gpm, injections will continue for 4 hours if average flow is less than 0.5 gpm, or for 2 hours if average flow is between 0.5 and 1 gpm. This rule may apply to wells MW-11S and MW-28S.

4. For monitoring wells containing TCE levels less than 500 ug/L, and unable to receive an average flow of at least 1 gpm, injections will continue for 2 hours if average flow is less than 0.5 gpm, or will continue for 1 hours if average flow is between 0.5 and 1 gpm. This rule may apply to wells MW-10A, MW-11D, and MW-22D.

5. For all injection (open borehole) wells unable to receive an average flow of at least 5 gpm, injections will continue for up to 4 hours.

2.5 Task 5 - Waste Management and Oxidant Delivery

The Waste Management Subcontractor will deliver and provide one 5,000-gallon poly tank to store the oxidant solution. The tank will be stored on the eastern side of the plant building. At the conclusion of Round 2 injection work, the Subcontractor will clean the poly tank and remove it from the site. It is assumed that the poly tank will not remain at the site for more than 2 weeks.

Any wastes generated during Round 3 will be containerized and transported off-site for disposal. The more likely wastes include drill cuttings from the new wells, groundwater from well development, wastewaters from the injection program, any spills that require neutralization, materials captured by containment structures around injection wells or monitoring wells, and materials captured at the decontamination pad.

Tetra Tech will issue a purchase order for the delivery of the pre-mixed 10% $NaMnO_4$ solution. The liquid $NaMnO_4$ material will be provided by the manufacturer, sent to an off-site blender, mixed to specifications, and delivered to the site in 5,000-gallon tankers. The tanker contents will be transferred to the

5,000-gallon tank. Two tanker deliveries are anticipated and will be scheduled several days apart to support the injection program.

2.6 Task 6 - Oxidant-Based Reactive Barrier

Instead of liquid oxidant injections, two portions of the groundwater plume will be treated using a potassium permanganate ($KMnO_4$) product dispersed in a paraffin wax matrix. The product will contain between 60-80% $KMnO_4$ as supplied by the vendor as RemOx® SR. The sustained released (SR) $KMnO_4$ will enable slow release of reactant over a period of time that may exceed 180 days. The in-situ product can be manufactured at various diameters, but is more readily available as 3-inch candles for larger diameter or open borehole wells and as 2-inch candles for small diameter wells (e.g., wells with PVC screening). The candles are safe to handle when dry, and eliminates many of the risks involved in liquid and pressurized injections of oxidant solutions.

The candles are made by mixing solid $KMnO_4$ crystals in a paraffin wax matrix in 3:1 ratio. The crystals eventually dissolve in migrating groundwater as paraffin wax is degraded. The 2-inch candles are roughly 3 feet in length by 1.5 inches in diameter and contain about 2.55 pounds of $KMnO_4$ and 0.86 pounds of paraffin wax to make a 75% $KMnO_4$ product. The typical application of the candles is to create a subsurface permeable reactive barrier.

The oxidant-based reactive barrier will be used for the portion of the plume near the southwest corner of the building at the site, as well as for the portion of the plume along Bent Pine Road/Trail. These areas were selected due to the presence of lower concentrations of TCE and other VOCs, the ability to measure contaminant reductions in nearby monitoring wells near the areas, and ease of implementation compared to ISCO injections themselves.

For the southwest corner, the barrier will consist of candles installed in existing wells MW-13S, MW-13I, E-5, and if installed, E-11. The candles can be stacked to focus on specific water-bearing intervals or the entire length of the well below the casing. Monitoring wells may include well clusters MW-2 and MW-23.

For the plume along Bent Pine Road/Trail, the barrier will include well GW-21 and well cluster MW-6.

Since the barrier wells for each of the two areas will not be ideally close together, it may be necessary to mix or recirculate the groundwater in the barrier wells. Pneumatic circulators that emit small air bubbles can be placed below the inserted candles in the well to facilitate better distribution of the $KMnO_4$. This approach would work better for those barrier wells that can be safeguarded for long-term operation (e.g., wells inside the building at the site such as E-11).

The size and number of candles to procure from the vendor will need to be determined if the oxidant-based reactive barrier approach is pursued further.

2.7 Task 7 - Post-Injection Support Activities

Upon completion of the injection work, the Subcontractors shall remove all equipment, unused materials, and debris from the site. The site shall be restored as nearly as practical to its condition before the work began. All structures or property damaged due to the Subcontractor's negligence shall be restored at their expense as nearly as possible to their original condition. All cleanup and restoration of the property shall be to the complete satisfaction of Tetra Tech.

The Drilling Subcontractor shall be required to decontaminate the equipment and materials needed in the performance of the work as described below. The Subcontractor will perform the decontamination at a location designated by Tetra Tech. Decontamination of down-hole equipment and pumps shall consist of the following:

- Spray neutralization with sodium thiosulfate solution (if necessary)
- Pressure wash equipment using steam genie and potable water
- Rinse equipment using potable water

2.8 Task 8 - Groundwater Monitoring Program

Tetra Tech will obtain groundwater samples from selected wells on a periodic basis following the Round 3 ISCO injection event and reactive barrier installation. The program will help determine the effectiveness of the injections and measure the spread of the solution (both laterally and vertically). Tetra Tech assumes samples will be collected from the monitoring wells for both chemical and physical parameter analyses.

For planning, Tetra Tech will conduct two rounds of performance monitoring after Round 3 injections. These events will occur at the end of Months 3 and 6. Low-flow sampling techniques will be employed for screened wells, while the team will purge one volume of groundwater from open borehole wells. If the permanganate ion (MnO_4^-) is present in a particular monitoring well, samples will not be taken from that well. If necessary, samples containing the presence of permanganate will be preserved using ascorbic acid in accordance with EPA/600/R-12/049 *Groundwater Sample Preservation at In-Situ Chemical Oxidation Sites - Recommended Guidelines* (EPA, 2012).

For each round of performance monitoring, samples will be collected from up to 22 wells. Samples will be analyzed for TCL VOCs using CLP Method SOM01.1 for each round. Table 2 provides the proposed list of wells. Tetra Tech assumes that these performance monitoring events will take 1 week per event (plus mobilization/demobilization and administrative support), and will not include the sampling of no more than two open borehole wells per event. A three-person team will perform the work.

After Round 3 injections, Tetra Tech will evaluate if monitoring wells near injection wells are affected by the oxidant solution based on the presence of permanganate's purple color in well water along with elevated manganese concentrations and ORP readings (referred to as process monitoring). Samples will not be collected for fixed-base laboratory analyses. The post-injection process monitoring events will occur up to four times. These events will occur during Months 1, 2, 4, and 7. Tetra Tech assumes that these process monitoring events may involve up to 28 wells each time, and will last approximately 2 days per event (including mobilization, equipment rentals, travel, and reporting). A two-person field team will perform the work.

Tetra Tech assumes that the total number of groundwater sampling events that will be performed under the WA may be conducted according to a different timeline or interval. For example, it may be necessary to carry out five process monitoring events after the Round 3 ISCO injections, but only three such events after subsequent injections (e.g., Rounds 3 and 4). This flexibility should be considered part of the WA SOW, assuming the overall number of groundwater sampling events does not change.

3.0 SCHEDULE

The anticipated start date for Injection activities is May 2014. Permission to perform injection work and other field tasks will be obtained by Tetra Tech and EPA. Most locations are on or adjacent to paved areas. Several locations are on a grass lawn where soft ground may be encountered. Two locations are inside the plant building. Vehicular and equipment access to these two locations is restricted by a 10 foot by 10-foot garage door. In addition, the ceiling height within the building is approximately 17 feet high. Tetra Tech will arrange for the garage door to be opened by the current tenant. The floor within the building consists of an approximate 6-inch thick concrete pad and contains steel reinforced rebar.

TABLE 1
ROUND 3 ISCO INJECTION APPROACH
VALMONT TCE SITE
WEST HAZLETON BOROUGH AND HAZLE TOWNSHIP, PENNSYLVANIA

WELL	INJECTION VOLUME (gallons)	INTERVALS (in feet bgs)		TCE CONCENTRATION (µg/L)	COMMENTS
E-1	NA	NA	NA	??	Injections not anticipated; may contain perm
E-2	1,000	32-52	90-150	450	Double packer setup; 600 gals shallow; 400 gals deeper
E-3	1,000	40-60	NA	500 (assumed)	Double packer setup; may contain perm
E-4	1,400	30-50	NA	250	Double packer setup
E-5	NA	NA	NA	19	Oxidant-based reactive barrier
E-6	130	95-115	NA	500 (assumed)	Indoors; double packer setup; may contain perm
E-7	1,090	18-38	40-60	190	Double packer setup; 545 gals each interval; may contain perm
E-8	NA	NA	NA	165	Oxidant-based reactive barrier
E-9	900	30-40	NA	9,200	Indoors; single or double packer setup
E-10	TBD	TBD	TBD	TBD	Double packer setup; possible new well
E-11	NA	NA	NA	TBD	Oxidant-based reactive barrier; possible new well
MW-10A	136	36-46	NA	210	Single packer setup
MW-11S	136	44-54	NA	2,800	Single packer setup
MW-11D	136	96-106	NA	61	Single packer setup; may contain perm
MW-12S	NA	NA	NA	ND	Injections not anticipated; may contain perm
MW-13S	NA	NA	NA	150	Oxidant-based reactive barrier
MW-13I	NA	NA	NA	230 (assumed)	Oxidant-based reactive barrier
MW-22D	136	294-304	NA	250 (assumed)	Single packer setup; may contain perm
MW-28S	272	35-45	NA	500	Single packer setup
GW-21	NA	NA	NA	73	Oxidant-based reactive barrier
TOTAL	TBD				

(1) Priority wells have TCE concentrations >500 µg/L, including wells E-3, E-6, E-9, MW-11S, and MW-28S.

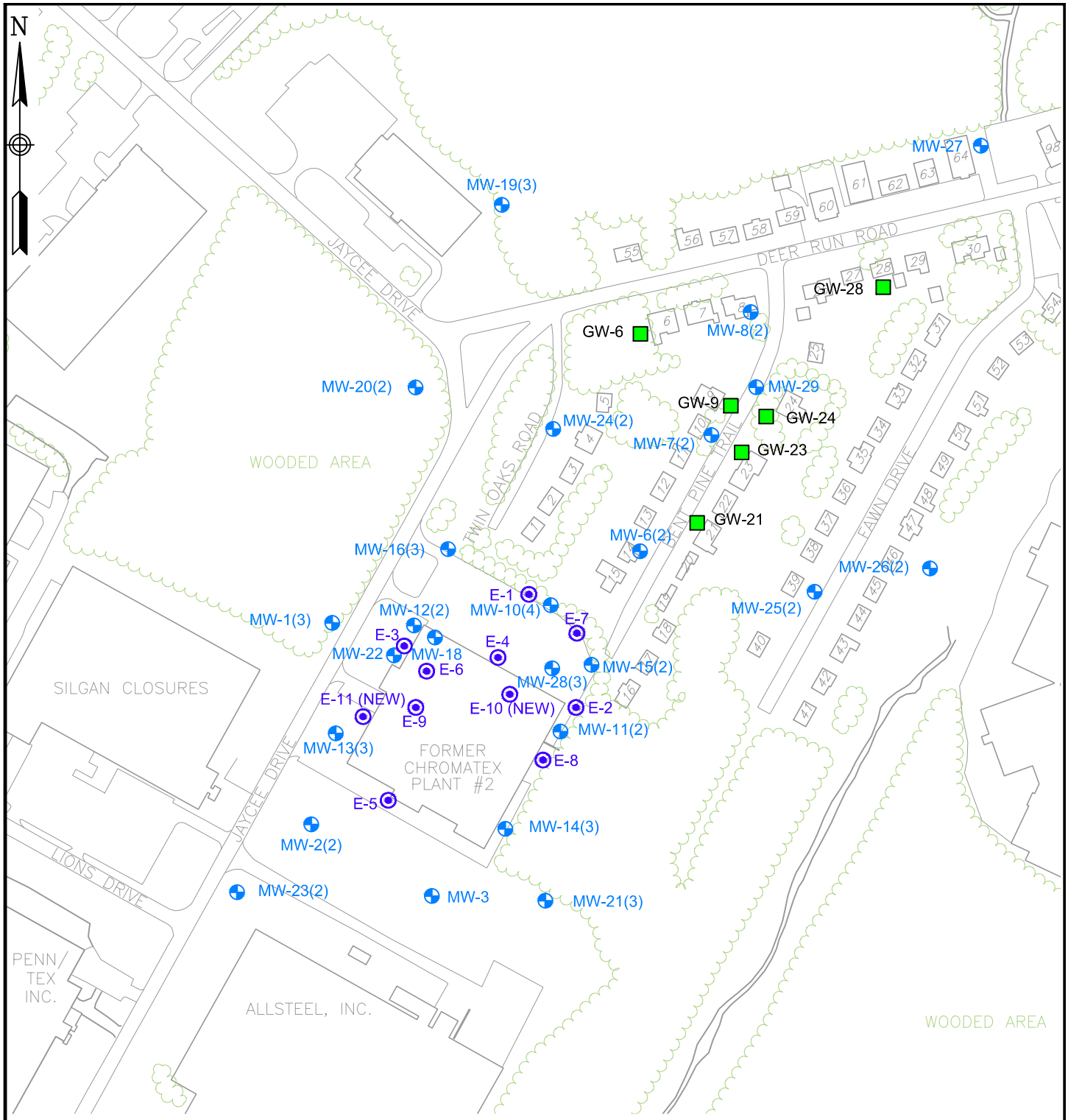
TABLE 2
GROUNDWATER MONITORING PROGRAM
VALMONT TCE SITE
WEST HAZLETON BOROUGH AND HAZLE TOWNSHIP, PENNSYLVANIA

WELL	PROCESS	PERFORMANCE[2]	COMMENTS [1]
E-1	▲	▲	
E-2	▲	▲	Round 3 Injection Well
E-3	▲	▲	Round 3 Injection Well
E-4	▲	▲	Round 3 Injection Well
E-5	--	--	Reactive Barrier Well
E-6	▲	▲	Round 3 Injection Well
E-7	▲	▲	Round 3 Injection Well
E-8	--	▲	Reactive Barrier Well
E-9	▲	▲	Round 3 Injection Well
E-10	▲	▲	Round 3 Injection Well
E-11	--	--	Reactive Barrier Well
2S	▲	▲	
2I	▲	--	
6S	--	--	Reactive Barrier Well
6I	--	--	Reactive Barrier Well
10A	▲	▲	Round 3 Injection Well
11S	▲	▲	Round 3 Injection Well
11D	▲	▲	Round 3 Injection Well
12S	▲	▲	
12I	▲	--	
13S	--	--	Reactive Barrier Well
13I	--	--	Reactive Barrier Well
15S	▲	--	
15D	▲	--	
18S	▲	▲	
22D	▲	▲	Round 3 Injection Well
28S	▲	▲	Round 3 Injection Well
28I	▲	--	
GW-21	--	--	Reactive Barrier Well
GW-23	▲	▲	
TOTALS	22	18	Plus QA/QC samples

Notes:

[1] Selected wells containing the presence of permanganate during monitoring may be sampled at the direction of EPA.

[2] All performance samples will be analyzed for VOCs. Selected comprehensive monitoring samples may be analyzed for total and dissolved metals.



LEGEND

- MONITORING WELL
- INJECTION/EXTRACTION WELL
- RESIDENTIAL WELL
- 25 RESIDENCE

0 300 600

SCALE IN FEET

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

EXISTING AND NEW WELL NETWORK
VALMONT TCE SITE
HAZLE TOWNSHIP AND
WEST HAZLETON BOROUGH
LUZERNE COUNTY, PENNSYLVANIA

SCALE	AS NOTED
FILE	112G03485GM30
REV	0
DATE	02/14/14
FIGURE NUMBER	FIGURE D–1